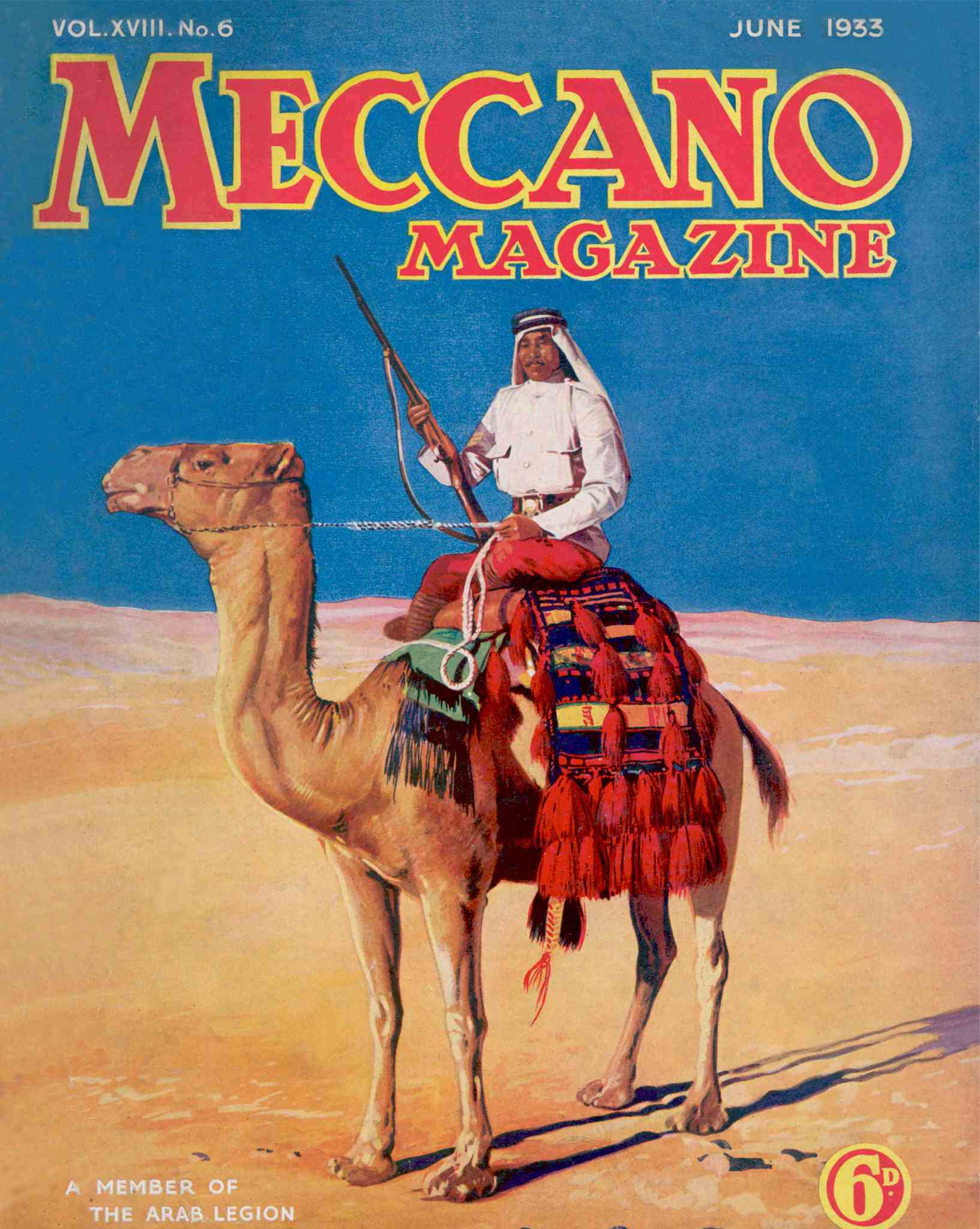
VOL. XVIII. No. 6 JUNE 1933

MECCANO MAGAZINE

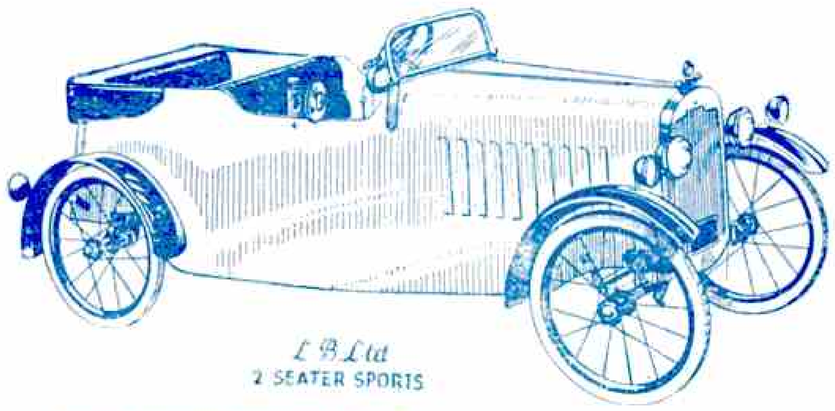


A MEMBER OF
THE ARAB LEGION
(see page 426)

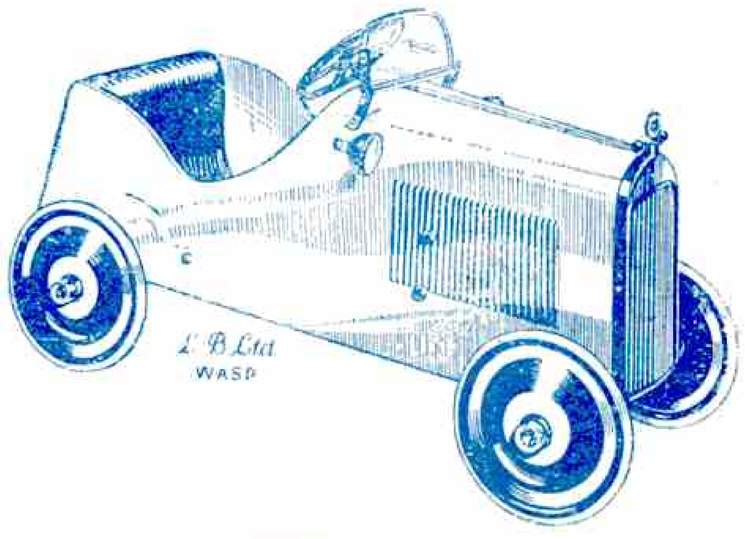
6D.

TRI-ANG TOYS

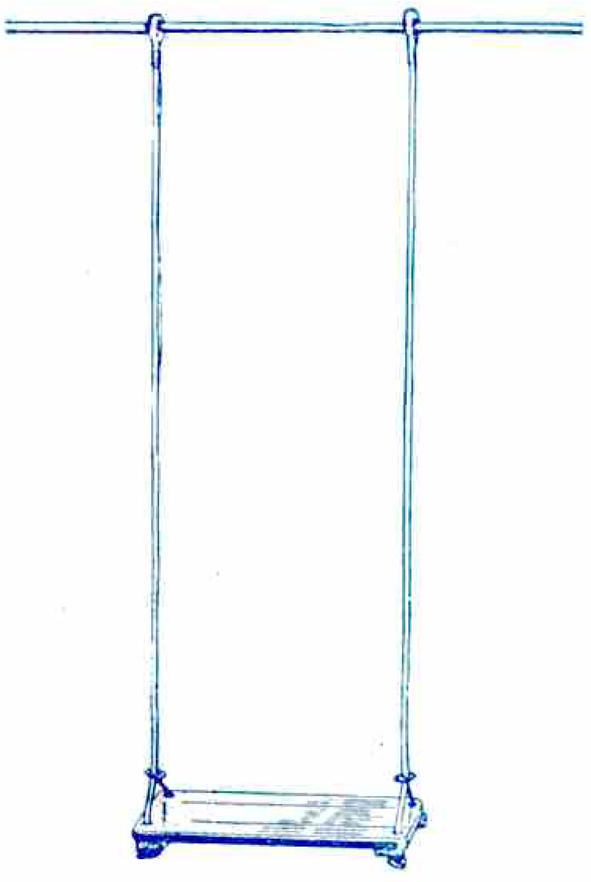
FOR SUMMER JOYS



TWO-SEATER SPORTS. Entirely new design with space for one to drive and for a younger child in back seat. Adjustable windscreen, dummy hood, mechanical horn, large wheels and 1–1/16" auto tread tyres. Sports mudguards, double crank drive, with rubber foot pieces. Price **84/-**



WASP. Latest sporting type car, 9" disc wheels, dummy lamp and windscreen. Finished in yellow. Excellent value. Price **25/-**



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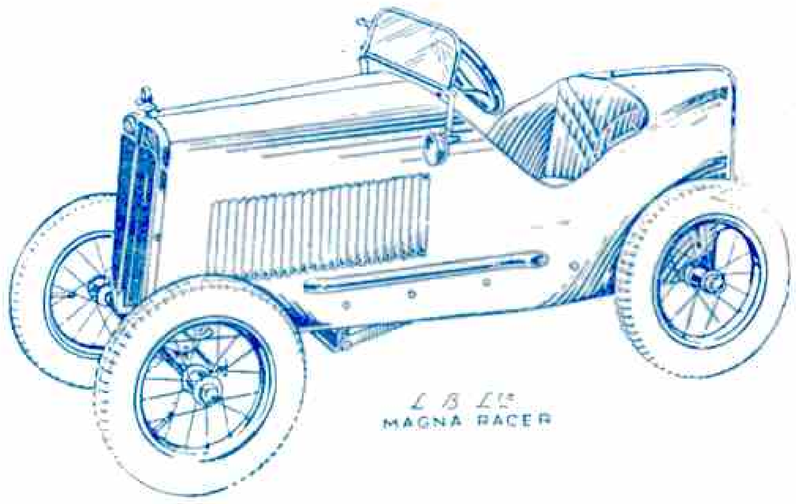


MAGNA RACER No. 8. Realistic sports car with polished aluminium body. New sports type radiator. Strong tubular front axle. Ball-bearing back axle. Crank drive. Fitted with 2½" Dunlop motor tyres with Schrader valves. A very attractive car. Price **87/6**

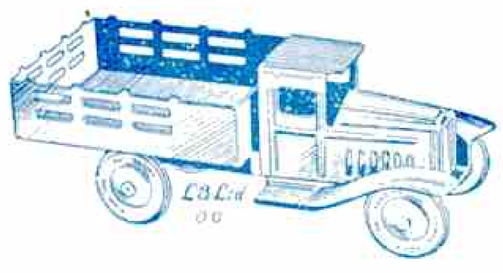
FAIRYCYCLE (Regd.) MODEL No. 2. Tubular frame. 14" wheels. 1–1/16th" white auto-tread tyres. Ball-bearing pedals and rim brake. Two-coil saddle and chain cover. Price **39/6**

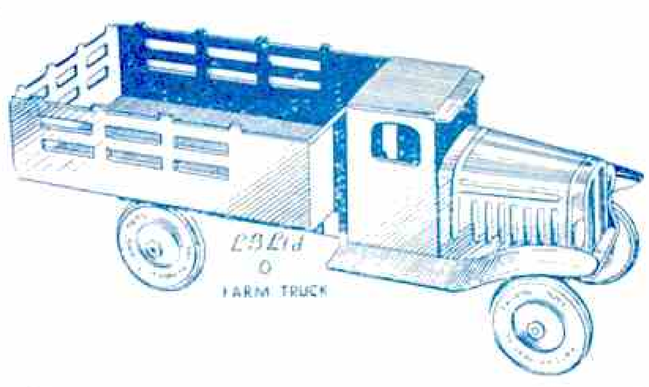
STEEL FARM TRUCKS and TIPPING LORRIES

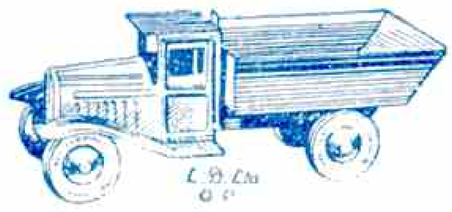
Here's a fine range of attractive NEW Toys—made of MOTOR GAUGE STEEL and fitted with easy running axles and SOLID RUBBER WHEELS. Both types are finished in Green or Red enamel and are available in three sizes as listed below. Be sure and get one of these inexpensive toys—they are immensely strong and almost indestructable.

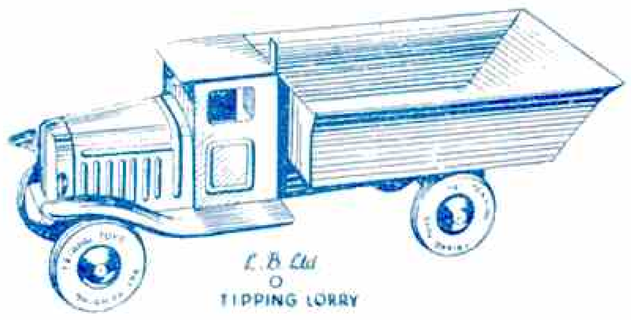
000 Size, 7¼" long and 3¼" high ... **6**d.
00 Size, 9¾" long and 3¾" high ... **1/-**
0 Size, 13" long and 4¾" high ... **1/11**

ALWAYS ASK FOR TRI-ANG TOYS









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NEXT MONTH: "A BAVARIAN MOUNTAIN RAILWAY." PUBLISHING DATE: 1st JULY

MECCANO MAGAZINE

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With the Editor

The Vanishing Hansom Cab

The taxi-cab has been a familiar feature of our towns and cities for so long that it is difficult to imagine what the streets would look like without it. Many of my readers indeed will scarcely remember any other type of vehicle plying for hire, and yet comparatively few years ago the four-wheeled and the two-wheeled horse cabs had matters almost all their own way. A few of these vehicles still survive, but they are rapidly approaching extinction even in the very smallest towns.

It is about 100 years since the hansom cab was introduced by its inventor, Joseph Aloysius Hansom. His first vehicle consisted of little more than a box hung in the centre of a square frame carried on two wheels that were actually higher than the vehicle itself. The doors were in front, and the driver was perched on the roof. The design of this vehicle was subsequently improved until it finally reached the form shown in the accompanying photograph. On account of its easy running and comparatively high speed the hansom came into extensive use, and maintained its popularity up to the period 1905-12, during which it was superseded by the taxi-cab.

Liverpool's last hansom cab. This vehicle is 36 years old, but still plies for hire in the centre of the city, and stands, very appropriately, near the Queen Victoria Monument.

It is a curious fact that in its early days, and more or less throughout its career, the hansom was considered not altogether respectable! This was particularly the case in Victorian times when serious-minded, and particularly elderly, people always rode in four-wheeled vehicles. The hansom played a great part in the sensational literature of its day, achieving its greatest fame perhaps in the popular thriller "*The Mystery of a Hansom Cab*," by Fergus Hume, which is worth reading even to-day.

A few hansoms are still to be found in various cities, the one shown in our illustration being the sole survivor in Liverpool. In London four hansoms are now licensed, the remnants of an army of more than 7,000 registered about 50 years ago. No doubt many of them yet linger in countries where the taxi-cab is not yet universal, and I was interested to learn from one of my readers that he saw many hansom cabs during a visit to Constanza, the well-known Roumanian port on the Black Sea.

The hansom cab provides one of the many instances in which an inventor reaped little reward from his efforts. Hansom sold his patent rights for £10,000, but all he ever received was £300. Fortunately cab-inventing was only a side line with him, his main occupation being that of architecture. He was the architect of Plymouth Cathedral, and of churches in Preston and elsewhere.

The Cost of a Comma

We are so used to the employment of punctuation marks in all written and printed matter that it is difficult for us to realise that at one time such marks were entirely absent. In early Greek and Latin manuscripts the writing is not only without punctuation, but goes on continuously without even being broken up into distinct words. In the 9th and 10th centuries long words were separated, but short words such as prepositions and conjunctions were still joined to the next succeeding word. A century or so later the smaller words also were made separate.

Of all punctuation marks the comma is apparently the most harmless, yet if inserted in the wrong position it is capable of altering completely the meaning of a sentence, sometimes with disastrous results. Probably the most costly comma on record is one that upset the calculations of the United States Government some 60 years ago. The Government had passed a Bill authorising the importation of certain articles free of duty. Among these articles it was intended to include "all foreign fruit-plants," but a clerk who copied out the list changed the hyphen to a comma, so that the wording became "all foreign fruit, plants." This was reproduced in the printed version, and it was impossible to correct it for a considerable time. Consequently, during this period "all foreign fruit" came in duty free, the revenue loss, it is said, being nearly £250,000!

The following story emphasises the importance of commas. A pompous Vicar was visiting a village school when a lesson on punctuation was in progress, the particular point dealt with at the moment being the use of commas. "Why waste time on commas?" demanded the Vicar. "Teach them something useful." When the teacher suggested that commas had their uses, the Vicar rudely called him an ass.

Annoyed at being spoken to in this manner in front of his class, the teacher wrote on the blackboard: "The Vicar says the teacher is an ass." Then, turning to the Vicar, he said: "I think even you, sir, will admit that these two commas make a difference." As he spoke he inserted the commas thus—"The Vicar, says the teacher, is an ass."

Most of my readers will have come across instances of humorous results produced by the misplacement or absence of commas, and I offer a copy of my book "*Engineering for Boys*" to the sender of the funniest example of this nature received before 30th June. Mark your postcards or envelopes "Comma Contest," and please do not forget to include your name and your full address.

Vast Deeps in the Great Oceans

Chasms in which Mount Everest would Disappear

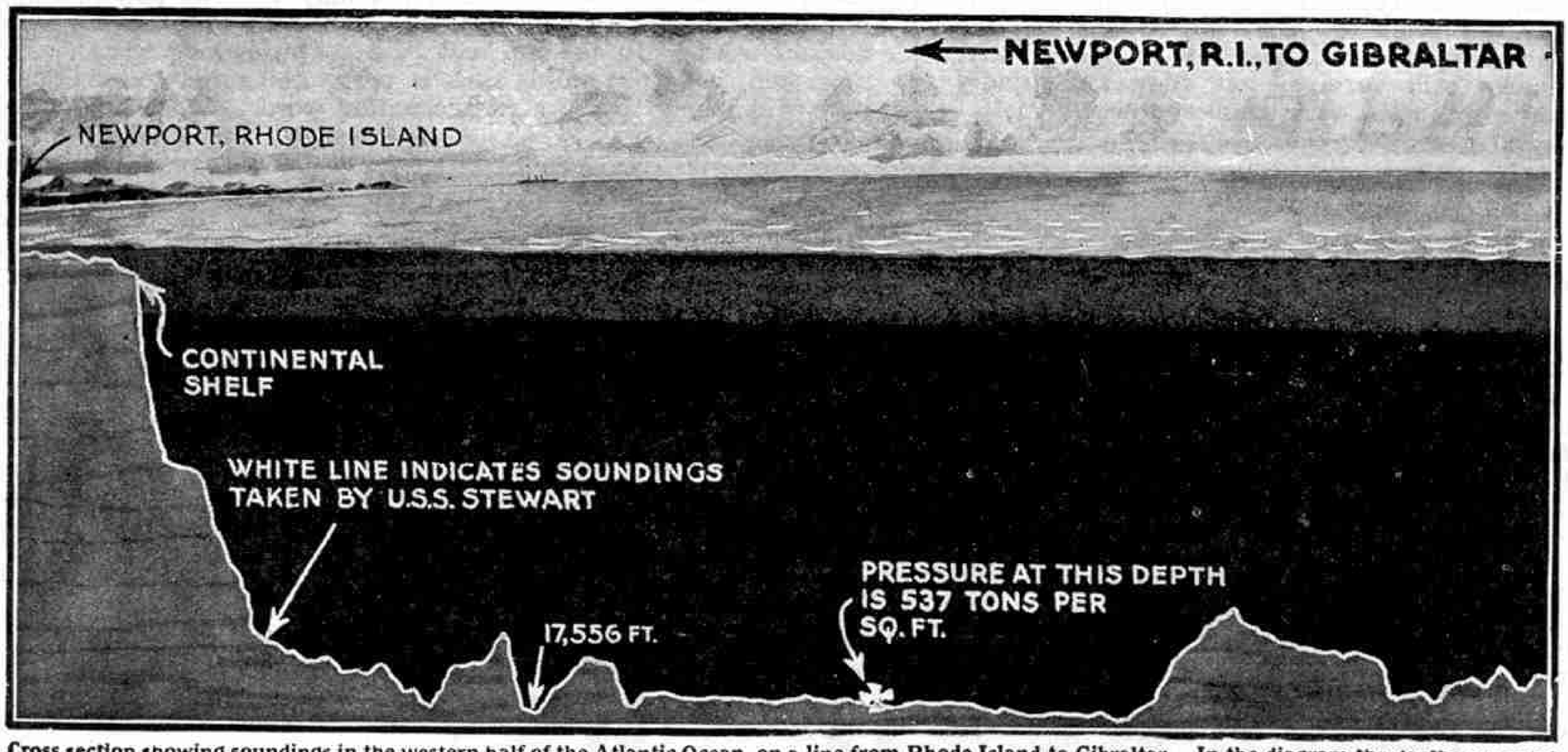
FOR countless centuries the great mountain ranges of the Earth were regarded with awe and reverence by human beings, who in pagan times peopled their summits with gods. For instance, the Greeks reverenced Mount Olympus, in Thessaly, as the place where Jupiter and other gods and goddesses met in conclave; and the Cretans worshipped Mt. Ida for similar reasons. At the present day the veneration of great mountain ranges has not ceased, but it has assumed a different form in civilised countries where great heights exercise a remarkable fascination and inspire heroic attempts to climb to summits that formerly were thought inaccessible. The highest mountain yet climbed is Kamet, a great peak 25,431 ft. in height in the Himalayas; and determined efforts have been made to conquer such giants in the same range as Kinchinjunga, and Godwin Austen, the heights of which are 28,250 ft. and 28,146 ft. respectively. Even Everest, the highest mountain in the world, is being attacked, and probably it is only a matter of time before human beings will set foot on its summit, 29,000 ft. above sea level.

The depths of the oceans probably would exert as great a fascination as the highest mountains if they were not at present beyond our reach. Thick leather suits and steel helmets designed to withstand high pressure are necessary when descending to depths of only a few feet, and elaborate means must be employed to supply air to the divers using them. The greatest depth at which work can be carried on with normal equipment is 300 ft., and even the divers of the "*Artiglio*," encased in the gigantic steel shell from which they directed the efforts of the men who raised the treasure of the "*Egypt*," descended to a depth of only 400 ft. Eventually the beds of the oceans may be explored in heavy steel cylinders provided with thick glass windows and equipped with powerful searchlights, but it will be a long time before man is able to reach depths at all comparable with the heights of the mountains he has climbed.

The oceans certainly present a wonderful field for exploration, for they have a surface area of 144,000,000 sq. miles and cover five-sevenths of the Earth's surface. They have an average depth of 13,860 ft., which is nearly as great as the height of Mont Blanc, the highest European mountain, and is six times the average height above the sea of the land surface of the Earth.

Countless valleys, plateaus and mountains may be traced on the beds of the oceans. Some of the valleys are very deep, and practically every ocean contains at least one trench that plunges to remarkable depths. Curiously enough, these trenches are not usually in mid-ocean, but near land. For instance, an astonishingly deep submarine ditch or valley exists in the Pacific Ocean off the east coast of Japan. It is crescent-shaped, and has an average depth of 24,000 ft.; but a few years ago a Japanese survey ship discovered in it one place where the depth is 32,636 ft., or about six miles. More recently a sounding of 34,120 ft. has been made there. A similar trench exists off Mindanao, one of the Phillipine Islands, where the sea floor at one point is 32,089 ft. below the surface.

It is difficult to imagine these amazing depths. The depth of the world's deepest oil well is only 10,296 ft., or less than one-third of the greatest ocean depth. Perhaps the best way of realising the immensity of these chasms in the ocean floor is to remember that the mighty Mt. Everest, the highest mountain known, if dropped into one of these trenches would not reach the surface of the sea. In the same place more than seven Ben Nevis's, or nearly nine Snowdons, would have to be piled on top of each other in order to show above water!



Cross section showing soundings in the western half of the Atlantic Ocean, on a line from Rhode Island to Gibraltar. In the diagram the depths are represented on a larger scale than that used for horizontal distances. The continental shelf shown on the left is a continuation of the mass of North America.

In the Atlantic Ocean there is a giant depression, known as the Porto Rico Trench, which sinks to a depth of 31,366 ft. The record depth of 44,000 ft. has recently been sounded in this Ocean, but there are few places where the depth is greater than 18,000 ft. The Indian Ocean is distinguished by the Sunda Trench, off the southern coast of Japan, the depth of which is 22,968 ft.; and even in the shallow Mediterranean there is one place, known as the Pola Deep, in which Mont Blanc could almost be submerged.

Although the great deeps of the oceans are situated near land, the areas immediately off the coast of each continent are usually shallow. The North Sea and the English Channel are less than 600 ft. in depth, and there is what is known as a "continental shelf" extending many miles into the Atlantic Ocean beyond Ireland. The depth of this shelf is less than 600 ft., but past its edge the ocean rapidly becomes much deeper.

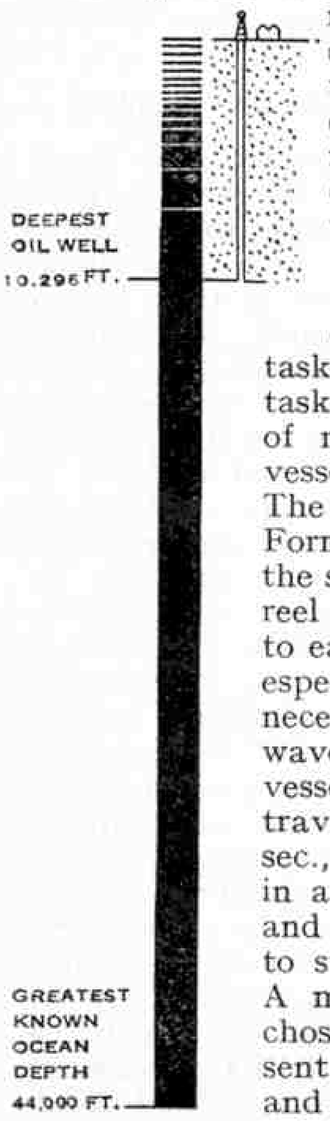
It is interesting to reflect that if the British seas were to recede to such an extent that their depths were reduced by 600 ft., or if Western Europe were to rise by a similar amount, the North Sea would become dry land, except for a narrow channel off the coast of Norway where the depth is now 1,988 ft.; and thus Great Britain and Ireland would become physically a part of Europe. In addition, new land extending many miles westward into the Atlantic would be laid bare, and the Orkneys and Shetlands would be united to the mainland of Scotland. If a similar change of level were to occur all over the world, Asia and America would be joined, and the Arctic Ocean would be cut off from the Pacific, for the Bering Straits would become dry land. Ceylon would become part of India, and New Guinea and Tasmania would be united to Australia; and it would become possible to travel on dry land from Sydney to Peking and thence to America.

In the past there have been many changes of this kind in the levels of the sea, but these have been brought about, not suddenly and universally, but gradually by the slow rise or fall of land in restricted areas. The existence round the Scottish Coast of beaches that now are many feet above sea level shows that the land there is higher than it was formerly. Similar raised beaches at heights up to 600 ft. above sea level in Norway contain shells of

exactly the same type as those found to-day in the beaches at sea level, thus proving that the movement that raised the beaches is recent and may yet be in progress. These raised beaches are not parallel to each other, or to the surface of the sea ; and in Southern Sweden there are definite indications that the land actually is sinking to-day. Scandinavia therefore is not being lifted uniformly but is tilting forward, the movement, of course, being extremely slow. Similar changes may be traced in historical times in Italy. There is a temple at Bæia, in the Bay of Naples, that when built, about 2,000 years ago, was well above sea level. To-day it is partially submerged, and its pillars bear marks that show them to have been sunk at one time to a greater depth than at present.

Slow upheavals on an enormous scale lifted the Alps and the Himalayas themselves to their present height. Formerly these ranges were below the surface of the sea, for the fossilised remains of shell fish that could only have existed in salt water may be found at heights of 10,000 ft. above sea level in the European mountains, and of as much as 19,000 ft. in the great Asiatic range. Part of the materials of which these mountains are built must have been slowly accumulated as sediment at the bottom of the seas of earlier eras, to be eventually consolidated into rock and thrust upward into the position in which we see them to-day.

The story of changes of this kind is by no means at an end, for slow rises and falls will continue and other mountain ranges no doubt will be formed. One of the great fascinations of the oceans is the knowledge that deep in their waters the mountains of the future are beginning their careers. Those of the present day are being worn away by frost, rain and other agents, and the tiny fragments into which they are being broken up are being swept down into the sea, there to accumulate and eventually to be thrust upward to form new land and new ranges of mountains millions of years hence. The shells and skeletons of countless sea creatures are being added to the ooze at the bottom of the sea. These will be embedded in the rocks of the future mountain ranges, and thus may reveal to the scientists of the far-distant future the character of the life with which our oceans are teeming.



To survey the depths of the oceans in the thorough manner adopted in land surveys in civilised countries would be an almost impossible task, for the area to be covered is immense. The task has been begun, however, for in the interests of navigation accurate charts are essential and vessels are continually employed in compiling them. The work has been made easier by recent inventions. Formerly the only means of finding the depth of the sea was to lower a heavy weight at the end of a reel of strong wire, and most of the time devoted to each sounding was spent in winding up the line, especially in deep waters. To-day it is only necessary to measure the time taken for a sound wave to be echoed back from the sea floor to the vessel from which it is sent out, and as sound travels through water at a speed of 4,758 ft. per sec., a single sounding in deep water may be made in a few seconds. The new method is so reliable and so speedy in operation that it is unnecessary to stop a vessel in order to make measurements. A modern survey ship simply steams along the chosen route and at brief intervals a sound wave is sent downward, the time between its despatch and the return of its echo being noted. A simple calculation then gives the depth. A complete line of soundings across the Atlantic Ocean therefore may be made in a few days, a task that with the methods formerly in use probably would have occupied as many months.

The floor of the North Atlantic is of special interest because this ocean is crossed by the world's busiest sea routes. Its most striking feature is the existence between Ireland and Newfoundland of a gigantic plateau with a uniform depth of about 12,000 ft. This is known as Telegraph Plateau. It is an ideal resting place for transatlantic cables, and cable-laying vessels steaming across it do not pass over deep submarine valleys or trenches into which the cable may suddenly plunge with disastrous results as it is being paid out at a uniform rate from the cable-laying machine.

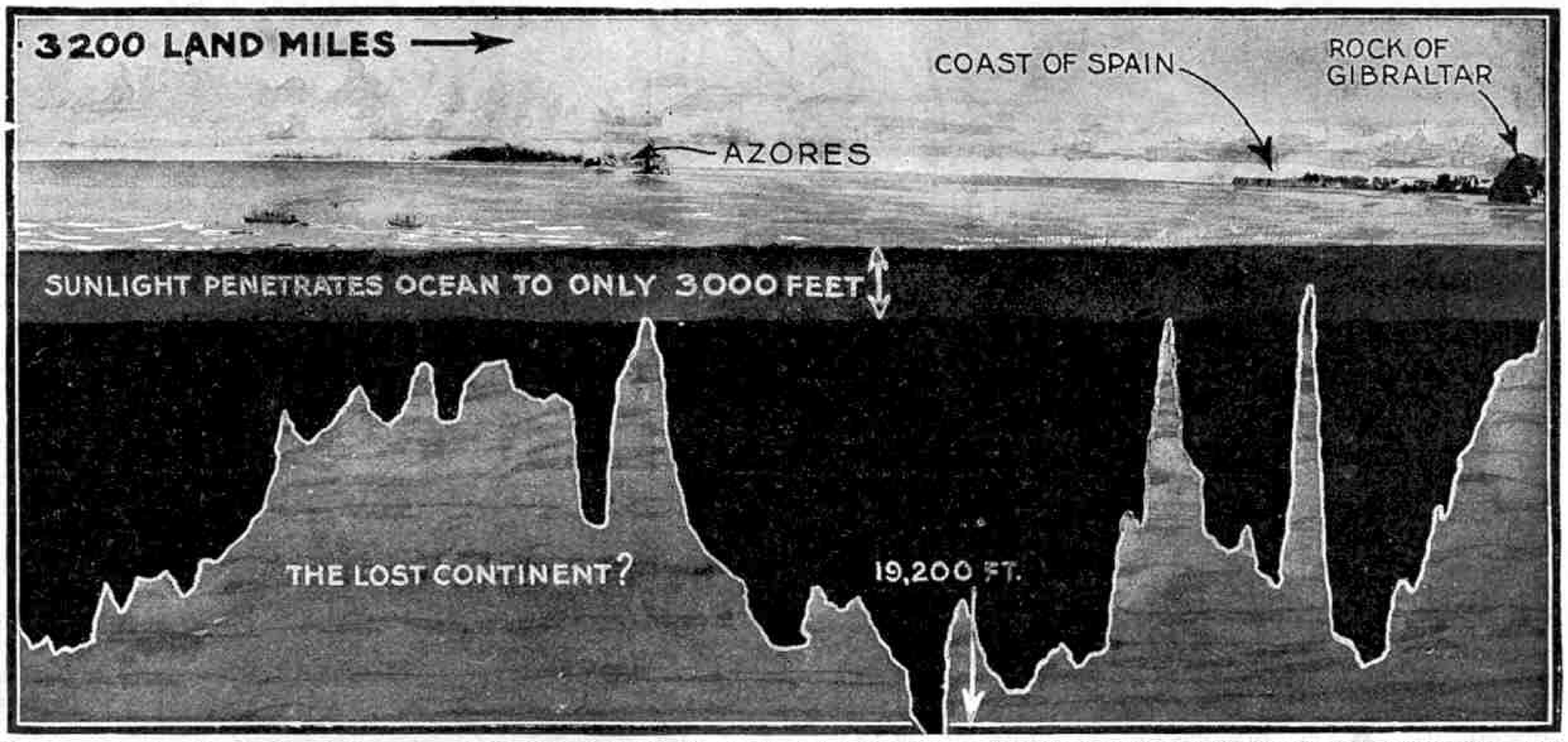
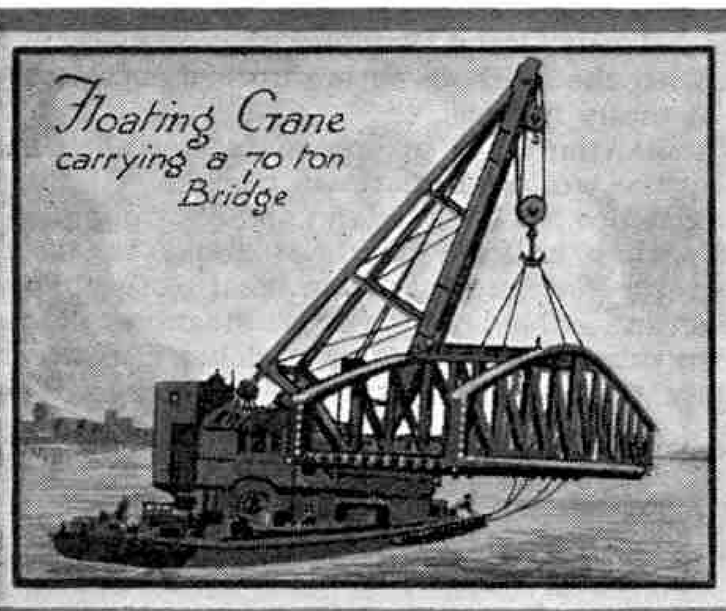


Diagram showing the depths of the eastern half of the Atlantic Ocean along the same line as those shown in the illustration on the opposite page. The Azores are the highest points of the great ridge rising from the bed of the sea in mid-ocean. This ridge may represent the lost continent of Atlantis.

Farther to the south the Atlantic Ocean generally is deeper except for the Dolphin or Azores Ridge, which runs southward through the Azores, Madeira and the Canary Islands and divides the floor of this ocean into two gigantic valleys. The existence of this ridge is seen plainly in our illustrations showing the depths measured along a line from Gibraltar to Newport, Rhode Island, in the United States, a distance of 3,200 miles. It will be seen that westward from Gibraltar the ocean rapidly becomes deeper until a depth of 19,200 ft. is reached. This is the bottom of the valley on the east of the Dolphin Ridge. Then the depth decreases until the ridge is passed. Further westward it again increases, and there is a long stretch at an average depth of about 17,000 ft. before the continental shelf on the east coast of the United States is reached. This shelf extends to a great distance from the present coast of America. At one time it was above the surface of the ocean, and the Hudson and other rivers flowed across it. The former valley of the lower course of the Hudson may still be traced in it, and now constitutes what is known as a " drowned valley," for it was submerged in the ocean as the land subsided.

The Azores Ridge, already mentioned, is a gigantic mass of rock rising above the general level of the floor of the Atlantic Ocean. It is so wide that it may almost be regarded as a submarine continent, of which the Azores and other Atlantic islands form the highest summits. It may really be the remains of an ancient continent sunk beneath the ocean, and there has long been a tradition that such a continent westward of Gibraltar was overwhelmed in a gigantic flood. The story has come down to us from the ancient Greeks, who learned it from Egyptian priests, the custodians of the oldest human records then known. The name of this continent was Atlantis, and it lay beyond the " Pillars of Hercules," as the rocky shores of the Straits of Gibraltar were then called. It was said to have been of enormous extent, and its inhabitants so numerous and warlike that at one time their Empire reached as far as Egypt and other Mediterranean countries. According to tradition, the Athenians resisted the invaders from Atlantis and repelled them, and shortly afterwards the continent was overwhelmed in a great earthquake and slowly sank beneath the sea.

It is impossible to decide whether this legend has any truth in it, but the existence of the great Dolphin Ridge suggests that it may have some foundation in fact.



Engineering News of the Month

Progress in Iron Road Construction

In previous issues of the *"M.M."* we have described cast iron sections that have been produced for road building by the Stanton Ironworks Co. Ltd., of Nottingham. These sections are provided with diamond-shaped studs in order to make the surface of the road non-skid, but it has been found that these studs wear out comparatively quickly. As a result of continued experiment a process has been discovered by which the studs can be provided with a hardened wear-resisting layer. This process consists of introducing certain chemicals into the parts of the mould that form the studs, thus causing a local change of composition to take place in the iron during casting operations. It is interesting to note that 50,000 sq. yd. of chilled iron roadway of this type have been ordered for use in the new Mersey Tunnel at Liverpool.

World's Largest Air-Conditioning Plant

The largest single air-conditioning plant in the world is to be installed in a new 70-storey building that is to be constructed in Rockefeller Center, New York City. In hot weather this plant will be able to absorb from the atmosphere in the building an amount of heat sufficient to keep 400 families, living in houses of average size, comfortable throughout an entire winter. The system will be capable of providing 400,000 cu. ft. of conditioned air a minute, and will maintain an average temperature of 70 deg. F. in winter, and a maximum of 85 deg. F. in summer. About 15 miles of air ducts will be installed in connection with the plant, which will cost more than £200,000.

Cable Ferry for French Island

For some time engineers have been investigating the best method of connecting the small island of Ile d'Oléron, lying in the Bay of Biscay, off the Charente-Inférieure region of France, with the mainland. The island is separated by a channel 1¾ miles in width, which is very shallow at low tide. It was at first proposed to build two viaducts connected in the middle by a lift or swing bridge to make a way for shipping. Another scheme put forward provided for the driving of a tunnel, while still another suggested the provision of a ferry. Owing to the cost of all of these schemes, it has been decided to build a cableway. This will be nearly 2 miles in length, and will have two lines, each of four cables, carried on standards placed at intervals of nearly 1,000 ft. The cars provided will be capable of carrying 150 passengers.

Heavy Oil Engines for Buses

During experiments carried out with heavy fuel oil compression ignition engines for omnibuses on the Cardiff transport system, two identical double-decker vehicles, one with a petrol engine and the other with a heavy oil engine, have been operated. In a year the bus running on heavy oil travelled 35,398 miles at a cost of £73 15s. 0d. for fuel, giving an average cost per mile for fuel of 0.43d. The cost of operating the petrol omnibus was 2.35d. per mile, although the engine developed less power than the heavy oil engine. The double-decker omnibuses in Cardiff run about 40,000 miles every year, so that if a change over was made from petrol to crude oil engines, about £320 a year would be saved on every bus.

An aerial view of the Hudson River Bridge. On the day that this bridge was first opened, more than 80,000 motor cars travelled across the structure. This has a span of 3,500 ft., which is the longest in the world.

Record Shaft Sinking in Africa

It has been claimed that world's records for rapidity and cheapness have been established in the sinking of a shaft by the West Rand Consolidated Mines in Africa. The shaft is also the only one on which work has been carried out continuously for more than a year, shifts working both by day and by night. It has a maximum vertical depth of 3,920 ft., and has been driven by 28 whites and a varying number of natives that at no time exceeded 240. Its cost per foot worked out at about £28.

Ice Blocks Used in Bridge Building

American engineers recently solved a difficult bridge building problem with the aid of a number of cakes of ice. They were erecting a 61-ton steel span across the Russian River in California to carry a new highway, and the three separate sections of the bridge were rolled into position and supported by falsework. The sections were then fitted together and the falsework was removed, leaving the bridge supported on jacks 3½ ft. above its proper position. The steelwork was then gradually lowered by the aid of the jacks, but it was found that the bridge could not be lowered the last six inches as there was not sufficient clearance between the beams and the piers to enable the jacks to be used.

After much discussion the bridge was raised again and six blocks of ice, each measuring about 56 in. in length, 21 in. in width and 10½ in. in depth, were brought to the site. Three of these were laid down on the two piers, directly beneath the end floor beams, and the jacks were lowered until the entire weight of the bridge was resting on the ice blocks. As these melted, the bridge slowly sank into its correct position. Each of the blocks of ice supporting the bridge carried a load of 20,000 lb., or 50 times its own weight, and they took 25 hours to melt.

Oil Barge Built by Electric Welding

An oil barge constructed by Swan, Hunter and Wigham Richardson Ltd., is the first Tyne-built vessel to be erected wholly by electric welding. The barge will be used to carry oil in bulk on the Great Lakes and canals of Canada. She is provided with four main tanks having a total designed capacity of about 1,700 tons, and is 179 ft. in length, with a beam of 34 ft. and a depth of 15 ft. Owing to the nature of the work in which the barge will be engaged, no propelling machinery can be installed. A steam pump is fitted in a special room in the stern of the ship, and this will be operated by steam supplied from the shore. There is also a small generator room housing the electric lighting plant. Filling and emptying operations are carried out through a main pipe, 8 in. in diameter, connected up to each oil compartment. This is arranged so that any of the tanks can be filled independently of the others, while at the same time oil can be discharged over both sides of the barge.

The practice of building vessels by welding appears to be growing, and should result in an appreciable reduction in cost.

Unique Suspended Dome at Chicago Fair

In the "*M.M.*" for March last was published an article dealing with the World's Fair that is to be opened at Chicago this month, and to continue until November next. Many extremely interesting buildings have been erected for the exhibition, but undoubtedly the most remarkable is a lofty circular hall that forms part of the Travel and Transport Building. This hall is provided with a huge steel frame dome, 200 ft. in diameter, that is not supported by pillars in the usual way, but is suspended from cables attached to a number of towers. This method of construction was adopted on account of the weight of the supports and the elaborate foundations that would have been necessary to take the weight of the trusses and columns to carry a dome built in the normal manner.

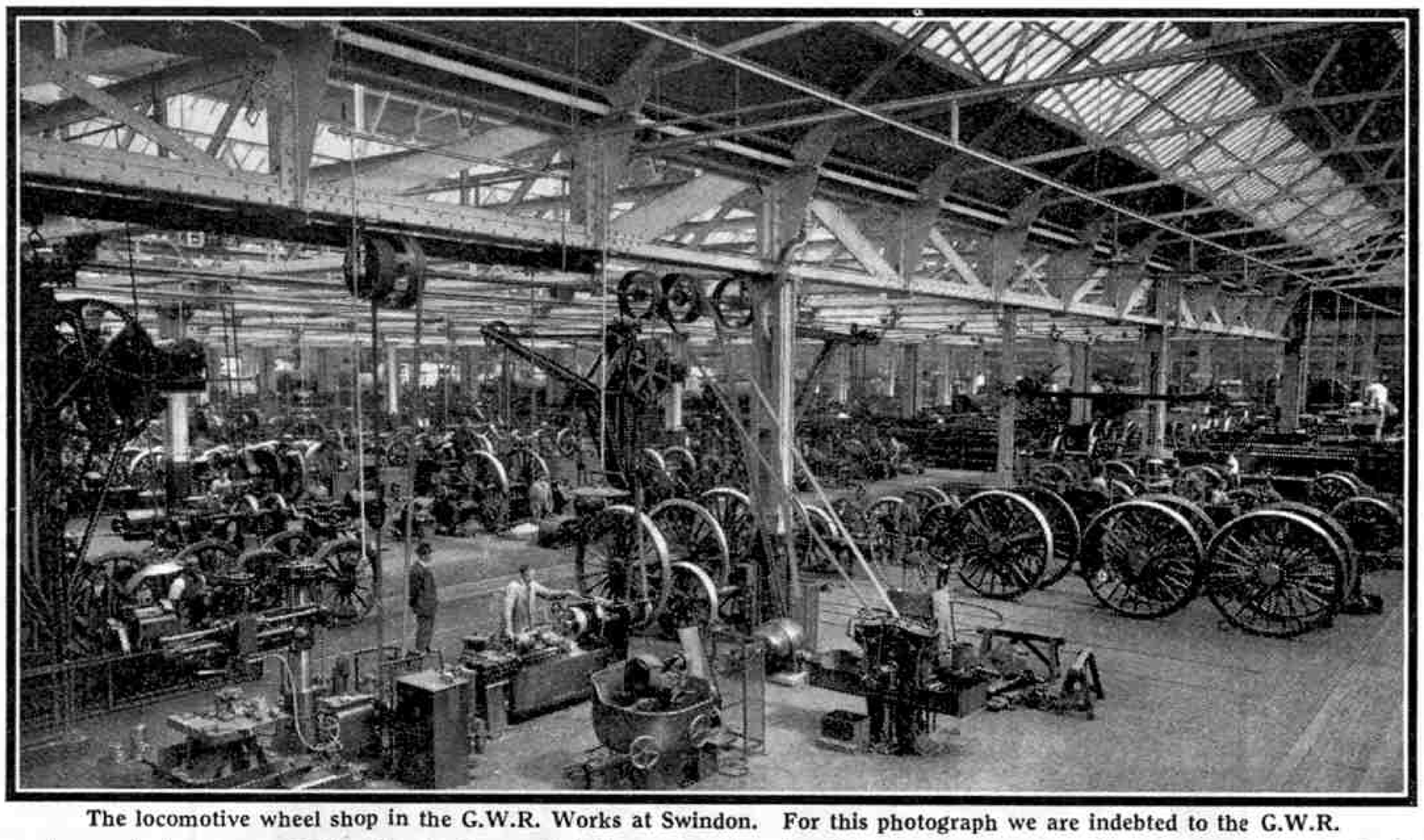
The dome is suspended from 12 steel braced columns or masts, 150 ft. in height, erected in a circle 212 ft. in diameter. Cables are slung from these masts, and from the cables special hangers connect with the skeleton framing of the dome. In order to resist the pull of the span cables the masts are provided with anchored backstay cables. Each of the masts is made up of two vertical members connected by horizontal struts and diagonal bracing. They are arranged in groups of three, connected by bracing, and thus form to all intents and purposes four towers. Huge blocks of reinforced concrete, 30 ft. long, 20 ft. wide and 11 ft. deep, are used as anchorages, and a riveted steel frame is embedded in each block. This frame projects slightly above the block, and has holes to take the ends of the cable sockets.

Huge Gate for Southampton Graving Dock

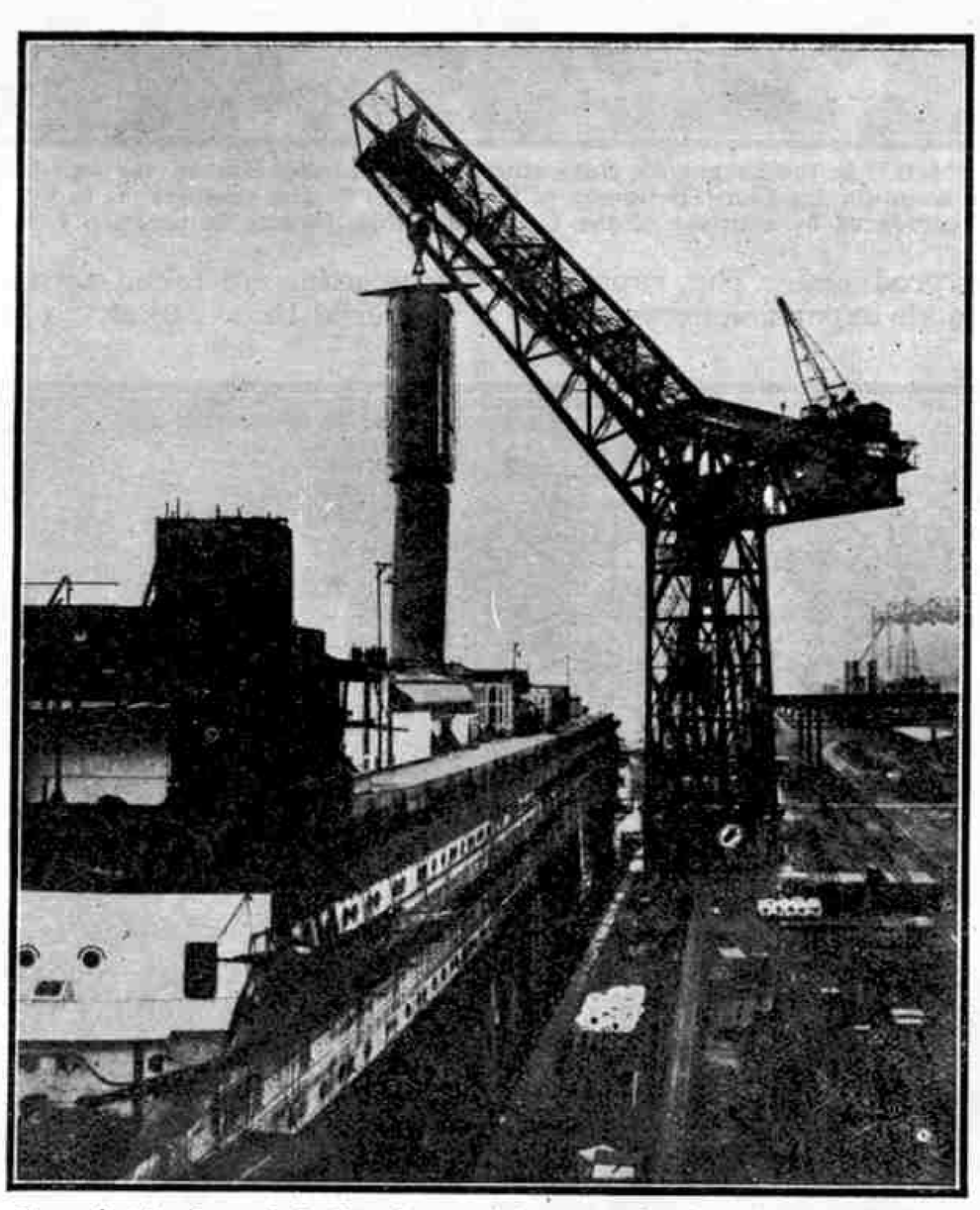
The gate has now been made for the new graving dock at Southampton that was described and illustrated in the "*M.M.*" for March last. The gate is 141 ft. 9 in. in length, 58 ft. 6 in. deep, and 29 ft. 6 in. wide. In its construction more than 1,700 tons of steel plates were used, and when it is filled with water ballast it will weigh about 4,600 tons. In service it will be necessary at times for the structure to withstand pressures up to 6,300 tons. The gate, which is claimed to be the largest in the world, was towed from the Tees to Southampton in about seven days. A visit to the dock is described on page 443.

An Interesting Gas Grid Scheme

There are many interesting features connected with a "gas grid" scheme in South Yorkshire, the first of its kind to be put into operation in this country. The laying of the grid trunk main was started in June, 1932, the first section being from the Grimesthorpe Works of the Sheffield Gas Company to the coke ovens of a chemical works some 4½ miles away. This main is constructed of welded steel pipe 24 in. in diameter, and is connected with the coke ovens by a smaller pipe 1,300 yd. long and 10 in. in diameter. A line has been laid also to other coke ovens in the neighbourhood, and supplies of gas are now being taken from both sources.



The locomotive wheel shop in the G.W.R. Works at Swindon. For this photograph we are indebted to the G.W.R.



Lowering the funnel of a liner into position, one of the last major fitting-out operations carried out before a vessel is ready for her trials.

New Dock Facilities at Cherbourg

An extensive development scheme has been in progress for some time at the port of Cherbourg. It has hitherto been necessary for Atlantic liners calling there to embark and disembark passengers by tender, but now the largest liners are able to berth alongside the new pier, on to which passengers may disembark quickly and comfortably. This pier is nearly 1,700ft. in length, and there is sufficient water alongside for the biggest liner afloat. Work is still proceeding on another long deep water pier and a great deal of dredging has been done. The spoil from the dredging operations has been dumped to increase the area of land available for wharves and warehouses.

An important feature of the new facilities is the Maritime Station, as it is to be called, which will be the second largest building in France. This will have many modern features and will have three distinct levels. Below ground there will be an area devoted to the movement of baggage, from ship to shore and from station to train, to facilitate which a system of moving belts will be employed. Customs and Immigration Inspectors' offices will be on the next level, which will contain also refreshment rooms and accommodation for passengers. The third section will be used for the handling of motor vehicles and tourists' cars. The whole scheme is costing well over £2,000,000.

End of Scapa Flow Salvage Operations

The work of raising the German warships sunk in Scapa Flow, Orkney Islands, carried out by Cox and Danks Ltd., is to be abandoned this year. Ten sunken vessels still remain, but no attempt will be made to raise them. The last two vessels recovered, the 20,000-ton battle cruiser "*Von der Tann*," and the 25,000-ton "*Prinz Regent Luitpold*," will be towed to Rosyth and broken up. The plant that has been used by Cox and Danks Ltd. for the work cost £70,000, and with it the firm succeeded in raising the "*Hindenburg*," the largest ship ever salvaged. The work of raising this vessel alone occupied 10 months and cost £75,000, and owing to the low price for scrap metal prevailing at the time, only £70,000 was realised. Before undertaking the operations, Cox and Danks Ltd., had not had any previous experience of salvage work.

The Largest Film Studio in Europe

Gaumont-British Enterprise

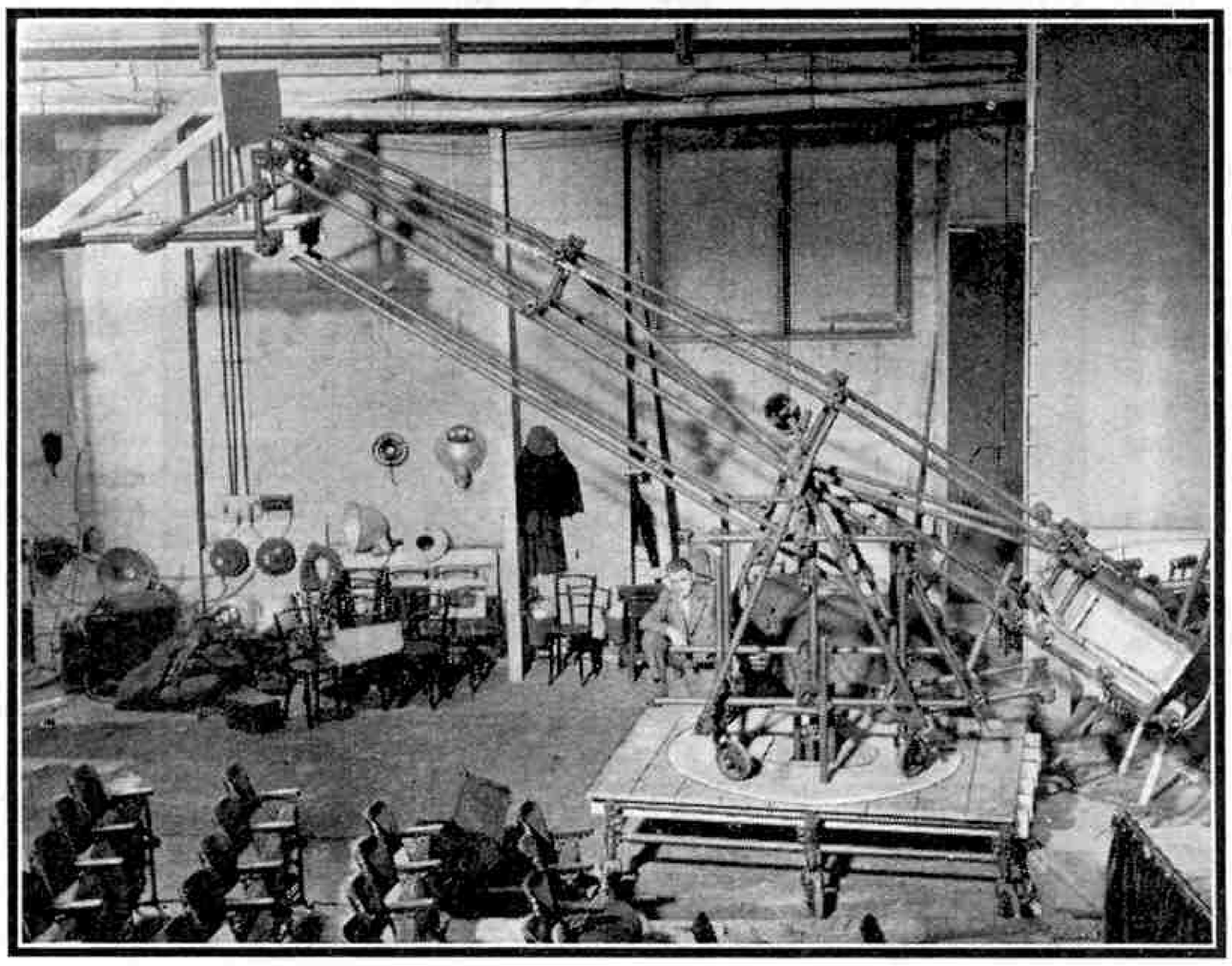
By Ellis Coughter

ONE of the most interesting features of the cinematograph world since the War has been the steady development of the British film industry. During the War the American film industry made enormous strides, both technically and commercially, whereas all British activity of this kind was at a complete standstill. The post-war British industry therefore started at a great disadvantage, and not least among its troubles was that of popular indifference. The attitude of the public has now changed, however. The British film has demonstrated its sterling quality, and is rapidly coming into its own, not only in this country, but also throughout the Empire and in many parts of the Continent.

A permanent landmark in British film progress was the formation in 1927 of the Gaumont-British Picture Corporation Ltd. This company acquired existing studios at Shepherd's Bush, and enlarged them and improved the equipment so that more and better films could be produced. The rapidly increasing demand for British films soon made expansion necessary, and last year the company opened at Shepherd's Bush new premises that include the largest film studio in Europe.

One of the "sets" in the Shepherd's Bush studios, with Gordon Harker, the well-known actor, playing in a scene for the film "Britannia of Billingsgate." The photographs to this article are reproduced by courtesy of the Gaumont-British Picture Corporation Ltd.

During a recent visit to London I had the privilege of being conducted over these remarkable buildings, and I was greatly impressed by the high standard of efficiency that was evident everywhere. The area of the site is 47,616 sq. ft. The main building has an overall length of 480 ft. and a breadth of 160 ft., and from its roof I was able to look down on the first sound-proof studio in Europe. This roof is 90 ft. above sea level, and is reached by means of lifts that also serve the various floors below. One of these lifts is large enough to accommodate a dray and pair of horses, and if required these can be carried up from the street to any studio on any floor, or up to the roof itself.



The camera crane invented, and used, at the Gaumont-British studios. It is built of tubular scaffolding and, with the camera and cameraman on the platform at its head, it can be swung, moved or dipped to any position required for taking a "shot."

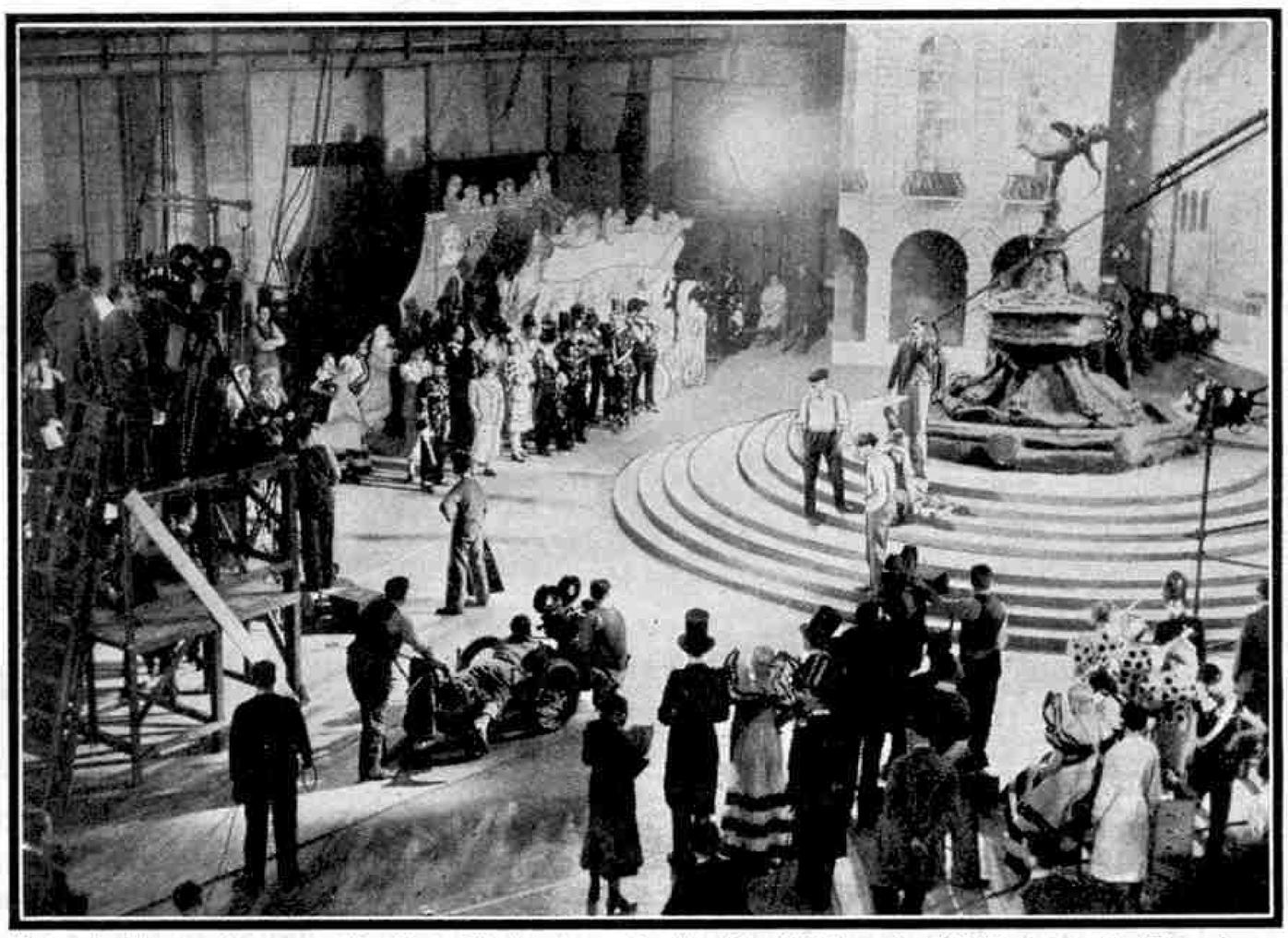
The roof can be used as a stage for filming or "shooting" outdoor scenes, but at the time of my visit it was being used for its general purpose, that of a salvage yard. On all sides were relics of "properties," as the scenery and stage furniture is called, used in previous films. I noticed, for instance, identification boards entitled "The Great North Road," and sign-posts marking the way to Bruddersford and other well-known places, all of which had been used in the recent film, "*The Good Companions.*" This film, by the way, is one of the longest British films ever made, and takes only a few minutes short of two hours to show. I also saw the motor car used by Miss Trant in this film, and many of the other stage properties used in the various scenes. In one part of the yard were numerous concrete paving stones from the platform that was constructed in the principal studio in connection with the Gare de Lyon station set for the "*Rome Express*" film, described in the "*M.M.*" last month.

When all the necessary shots of a set have been made, stagehands soon begin its demolition so as to make room for the assembly of some other set. The used properties are taken up to the salvage yard and there classified, material that is likely to be of use for future films being carefully stored and the remainder broken up. Men are kept busy all day removing salvage timber, etc., from the sets.

The five studios, or stages, situated on various floors of the building, have a total floor area of 90,000 sq. ft., or over two acres. These studios vary in size, the largest of them being 120 ft. long, 85 ft. wide, and 35 ft. high and, as already mentioned, the biggest of its kind in Europe. It is used for exceptionally elaborate sets, such as the wonderful reproduction of the train and the interior of the Gare de Lyon station, Paris, used in the "*Rome Express*" film. An interesting feature of this great studio is a large water tank 48 ft. long, 28 ft. wide, and 10 ft. deep, and of 270 tons capacity, that is used for "seaside" scenes. The dressing room accommodation at the studios is sufficient for 500 to 600 persons.

When we descended from the roof I was escorted through the various studios, and in four of these I saw sets being built up in connection with the film "*Britannia of Billingsgate*" that was

then being made. In each studio the work was progressively advanced. In No. 4 studio, for instance, the carpenters were just commencing to build up a room to be used for one of the scenes. In No. 3 studio the construction of a striking replica of Piccadilly Circus was almost completed, and in No. 2 studio the finishing touches were being given to the inside of a public house that had to be ready for the actors the next day. The largest studio, known as "No. 1," interested me the most, however, as it contained a wonderful representation of Billingsgate Market. The amount of detail put into these sets was extraordinary. In the Billingsgate Market set, for instance, the outside of the market had been built up so completely that I found it difficult to realise that I was standing in a large room on the second floor of a building, and not actually in the market itself. The entire floor of the room was laid with full-sized cobble-stones; there were gutters and iron grates for the water to drain away, and even orange peel and match boxes were to be found in the gutters.



Preparing to shoot a scene of a Piccadilly burlesque for the film "Britannia of Billingsgate." The microphone is hanging over Violet Loraine on the steps. One of the three cameras used is mounted on a low truck so that it can be moved forward for shooting "close-ups."

At the time of my visit to this set they were shooting a scene featuring Gordon Harker, the well-known star who plays Cockney parts so effectively. This part of the film is concerned with the activities of a film company who are taking a film of Billingsgate, and in the middle of the "street" a travelling "talkie" van was standing. Gordon Harker, in the role of a Billingsgate porter, comes up the steps of the van with a companion, at the same time saying something to the effect that "there is nothing in taking moving pictures—you have only to turn a few knobs!" He then explores the interior of the van, turning a few knobs in the meantime, and when he turns the wrong knob there is a violent explosion and he is blown backward out of the van.

The studio-built van was equipped with the camera apparatus used in "talkie" vans, but was roofless, so that the interior could be adequately lighted for the scene to be shot. One side of the van was omitted, so as to provide a clear view of the interior to the two studio cameras focussed on the scene. The microphone was suspended from above the van by means of a long arrangement like a portable crane, and was in charge of one man. The set was lighted by arc lamps, and by hundreds of incandescent lamps massed in reflectors suspended from the ceiling by special tubular scaffolding that enabled them to be readily placed in any required position. It is interesting to note that this tubular scaffolding was worked out in detail by the chief engineer with his son's Meccano Outfit when the company were experimenting in order to find the best method of fixing the lighting system.

Directing another scene for the film "Britannia of Billingsgate."

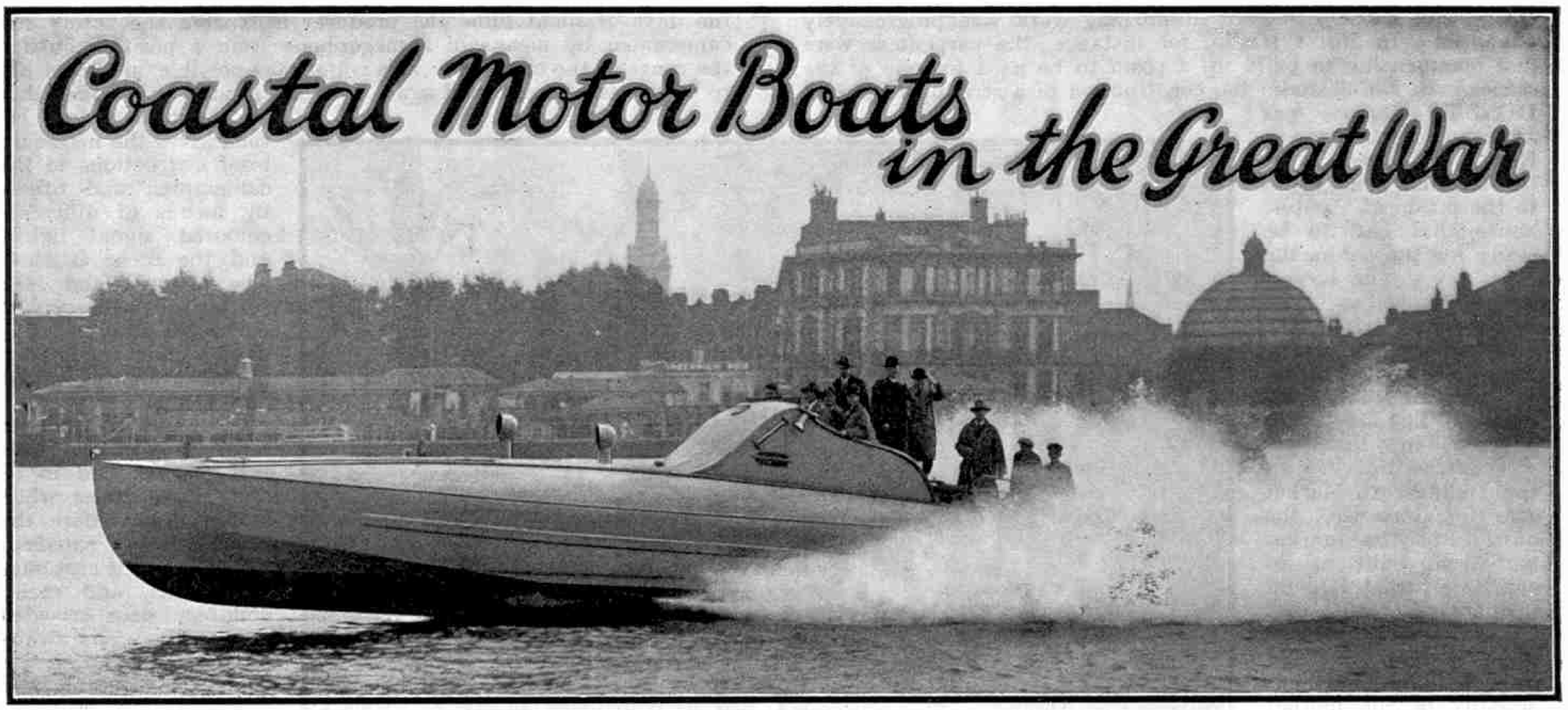
The producer and other technical experts were grouped around the cameras, each of which was muffled to deaden the sound of its mechanism so that this would not reach the microphone. In the days of silent films the producer instructed the actors and cameramen by means of a megaphone from a position outside the range of the cameras. This is not now possible, and a set has to be rehearsed again and again until the producer is satified that everything is perfect. He then gives the necessary brief instructions to the cameramen and others by means of different-coloured signal lights, and the scene is shot. The sound and the picture are photographed on two separate negative films, and these two films are finally printed on to a single positive film. The Billingsgate scene to which I have just referred had to be done three times while I was there before the producer was satisfied.

Actors in the costumes of citizens, and many children, were crowded around the scene awaiting their call, and porters from Billingsgate Market, together with railwaymen and railway vans were also there. Large numbers of fish boxes had been brought from Billingsgate, and the strong smell of fish that emanated from these added still further to the realism of the scene. I found it indeed difficult to believe that I was only in a film studio. Half-a-dozen dirty little children were looking on, and for a moment I wondered why the film company allowed them to be there on so important an occasion. Then I discovered that they, too, were actors, and were part and parcel of the great set! The scene that I saw taken will probably last 20 seconds on the screen, whereas the three shots that were made of it while I was there took over half-an-hour to complete.

The various sets for the films are built up from blue prints designed in the drawing office, and an army of carpenters is kept busy in fitting them together according to the instructions. Painters, plasterers and blacksmiths are also at work, each on their respective tasks. The floors are covered with numerous cables varying in size from that of a lead pencil to the thickness of a man's wrist, most of them carrying the heavy current of the arc lamps. These lamps give so bright a light that in a studio at night one seems to be standing in the bright sunlight of a summer's day. The lighting units in the studios total 650, and I was interested to hear that the original Shepherd's Bush studio had only 60 units. The high-intensity illumination necessary to light up the sets when shooting is taking place makes film acting very warm work. The considerable rise of temperature when the lights are on also makes adequate ventilation very important, and 14 tons of fresh air is passed into the studios every hour.

The laboratories at the studios are the finest in Europe, and they can turn out 4,000,000 ft. of finished film per week. In addition to developing, printing and assembling the big feature films, the laboratories also deal with the Gaumont News film, and a news film received one day can be printed off (*Continued on page 470*)

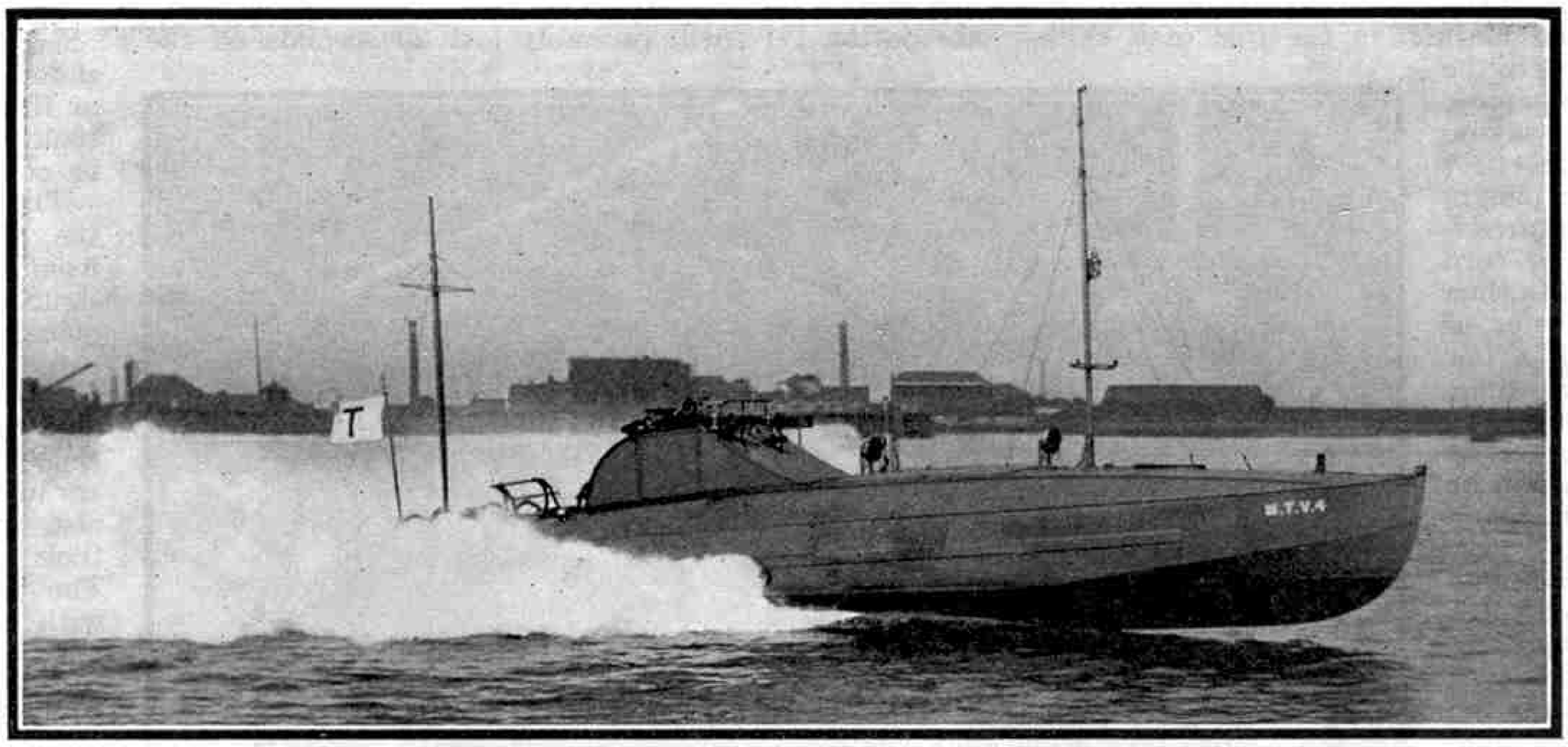
Coastal Motor Boats in the Great War



IN the early days of the modern Navy small high-speed craft were looked upon as the proper type of vessel to fight with the Whitehead torpedo. During the 30 years or so preceding the Great War, however, torpedo boats grew in size until they became really small cruisers, and the fighting that took place during the War, except in the case of the Jutland Battle and one or two other instances, showed that their work would mainly be done with their guns. It seemed, therefore, that anything in the nature of the early torpedo boats was a thing of the past, but the War had not been long in progress before the idea of employing small motor torpedo boats was put forward. The extensive use of mines made it extremely difficult for submarines and boats of considerable draught to approach the enemy bases, with the result that the smallest possible vessel with a great speed was again the obvious means of carrying the Whitehead torpedo to attack the enemy.

It is well known that the first torpedo boat in the British Navy, which appeared in the early seventies, was built by the famous firm John I. Thornycroft & Co. Ltd., and large numbers of similar small craft were built for all parts of the world. With the development of the internal combustion motor the firm designed and built a 40-ft. motor torpedo boat for the Russian Government during the Russo-Japanese War. In France, the "*Vedette Récope*," a small torpedo boat, was experimented with in the early days of motors, and doubtless the idea of reviving the quite small boat, propelled by motor instead of by steam, was considered in many navies.

During the 10 years or so before the War the Thornycroft firm had developed a special form of hull that was the outcome of many years' experiment by the founder of the firm, Sir John I. Thornycroft, F.R.S., and Mr. Tom Thornycroft. This hull would not only skim on the surface of the water when driven at high speed, but also had good sea-going qualities.

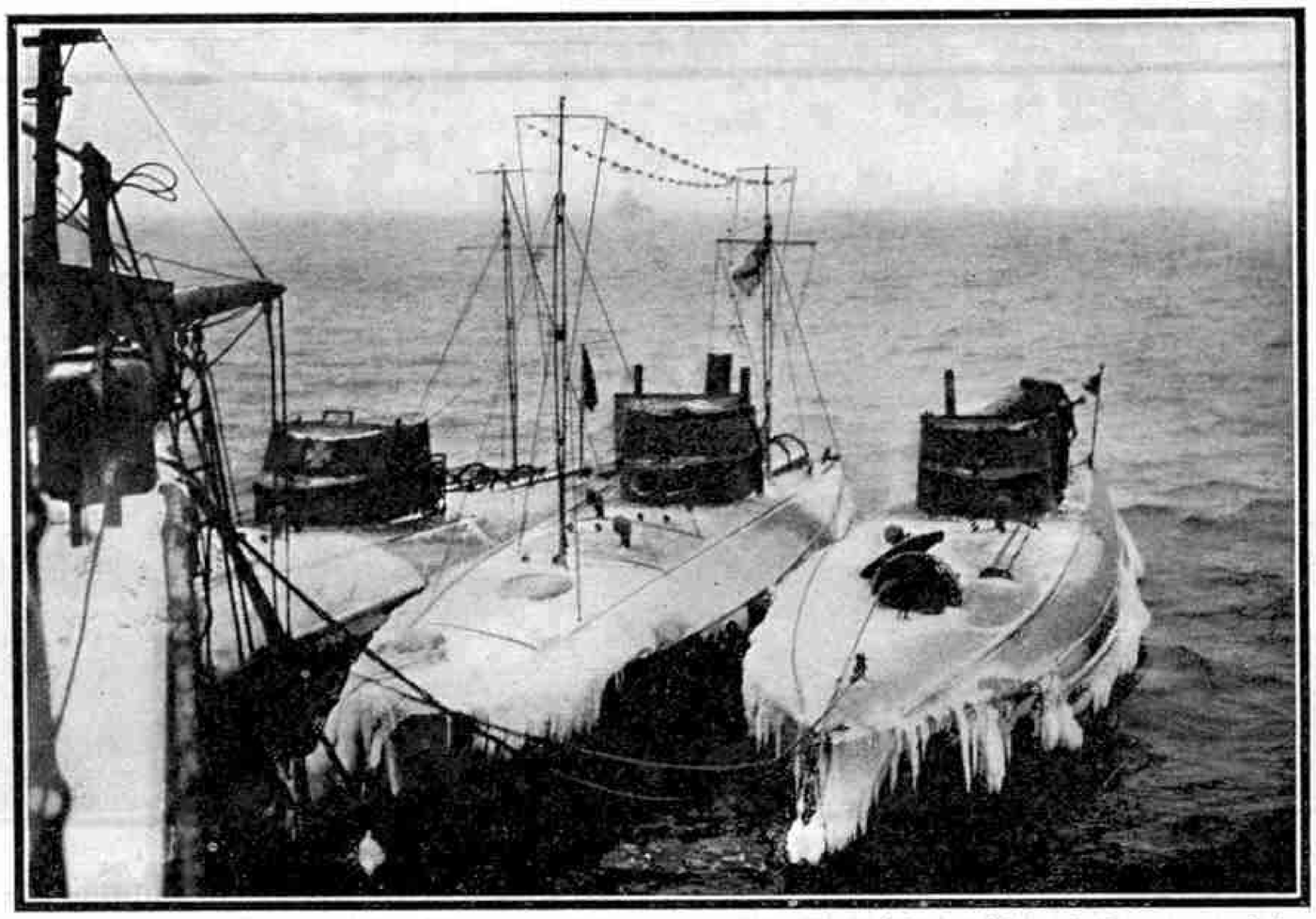


The two illustrations on this page show Thornycroft Coastal Motor Boats at speed. The vessel shown in the bottom photograph is one of two 55-ft. boats, with a speed of approximately 38 knots, supplied to the Finnish Government. The illustrations to this article are reproduced by courtesy of John I. Thornycroft & Co. Ltd.

In the early summer of 1915 the firm prepared designs showing this type of boat fitted for carrying a torpedo in a dropping gear, and submitted these to the Admiralty. Shortly afterwards three young officers from the Harwich Force, Lieutenants Hampden, Bremner and Anson, who had urged on the authorities the adoption of high-speed motor torpedo boats, were authorised by their commodore to approach Thornycrofts and ascertain what could be done. Their proposal was to build the smallest possible boat that could carry a torpedo. The weight of the boat, complete with its torpedo, was not to exceed that of the ordinary 30-ft. motor boats carried in the davits of the light cruisers. A speed of not less than 30 knots was considered necessary to give the boats any chance of success, and fuel for a considerable radius of action was imperative.

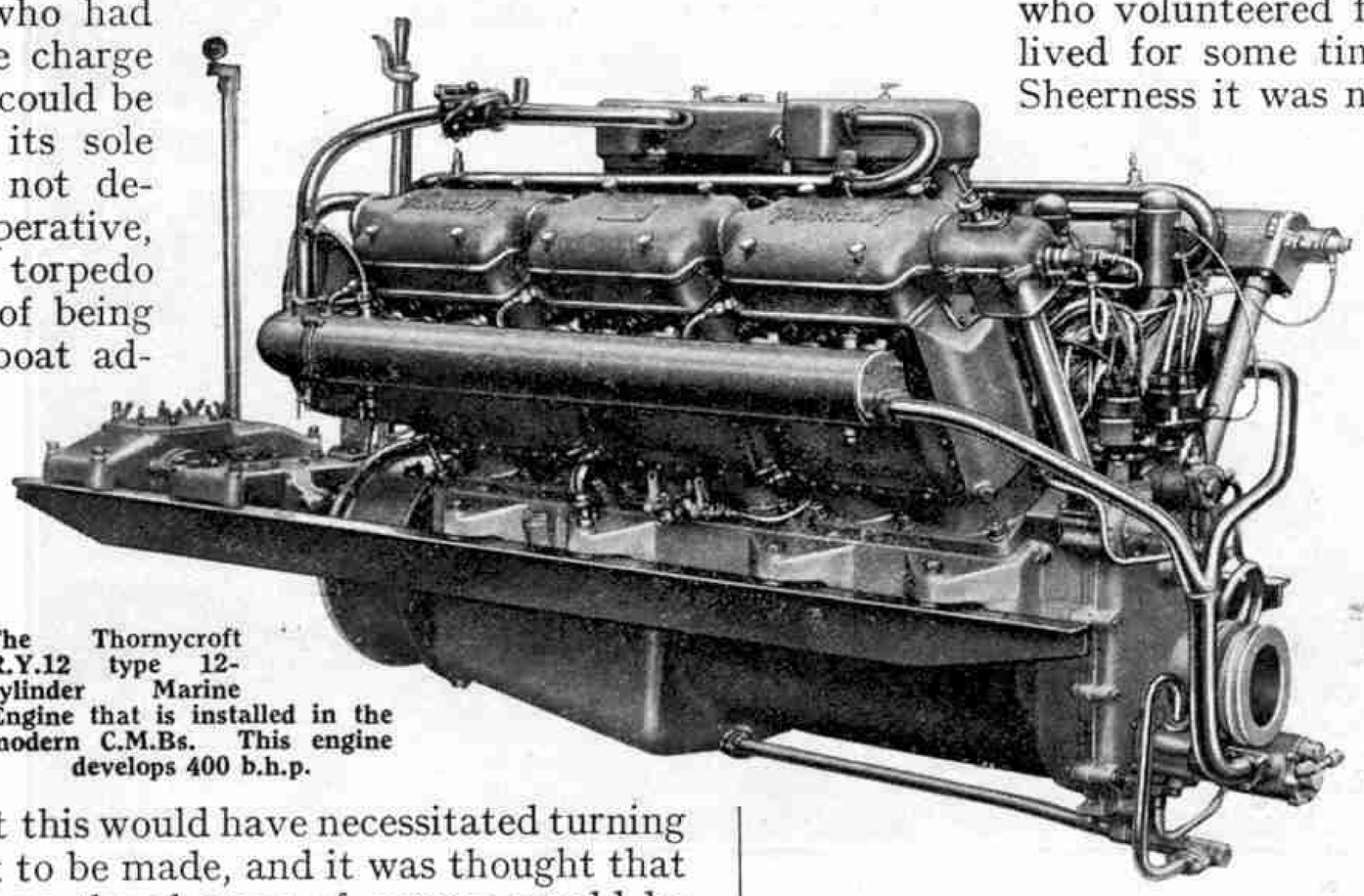
At first sight the conditions seemed extremely difficult to be fulfilled, as the high-speed racing boats that had been built had never carried any greater load than their

crew and sufficient fuel for a short race. They had never been designed with the necessary lifting gear and stiffening to enable them to be hung in davits with a heavy load. The torpedo itself, amounting to about three-quarters of a ton, and the discharge gear also had to be provided for. From the data available concerning boats of the type they had already built, and from model experiments that they had undertaken, the firm decided that they could fulfil the conditions, but the best method of carrying and discharging the torpedo was considered to be uncertain.



C.M.Bs. alongside the parent ship in the Baltic during October 1919, giving an idea of the severe winter conditions that were encountered.

The earliest torpedo boats carried their torpedoes in a dropping gear, but this had never been employed for anything larger than a 14-in. torpedo, and it necessitated the boat being brought to a very slow speed before the torpedo could be released. In some of the early Thornycroft boats built for the British Navy the torpedoes were carried in a shoot or trough in the bow and discharged by being pushed out by a ram; but the bow discharge had been abandoned for many years as a bad plan. The idea of the officers who were urging the new scheme, and who had volunteered to take charge of the boats if they could be obtained, had for its sole object attack and not defence. It seemed imperative, therefore, that the torpedo should be capable of being discharged as the boat advanced to the attack at high speed.



The Thornycroft R.Y.12 type 12-cylinder Marine Engine that is installed in the modern C.M.Bs. This engine develops 400 b.h.p.

It was found comparatively easy to arrange a satisfactory means of carrying the torpedo and discharging it over the stern, but this would have necessitated turning to enable the attack to be made, and it was thought that if this had to be done the chances of success would be greatly reduced. Eventually the happy idea occurred of discharging the torpedo over the stern, tail first. It was thought that if the boat were travelling at about the same speed as the torpedo, there would be a good chance of her being steered clear of the track of the torpedo after it had been discharged. It was felt that the success of such a scheme could only be determined by trial, and so an experimental boat was got ready as quickly as possible. The only boat available was not a very fast one, but from the trials that were carried out towards the end of the year, the torpedo specialists decided that there was every chance that it would prove successful with a boat having a speed of over 30 knots. In the meantime detailed designs of the proposed boat had been prepared, and in January, 1916, the First Sea Lord and Sir Henry Jackson decided that twelve boats should be built.

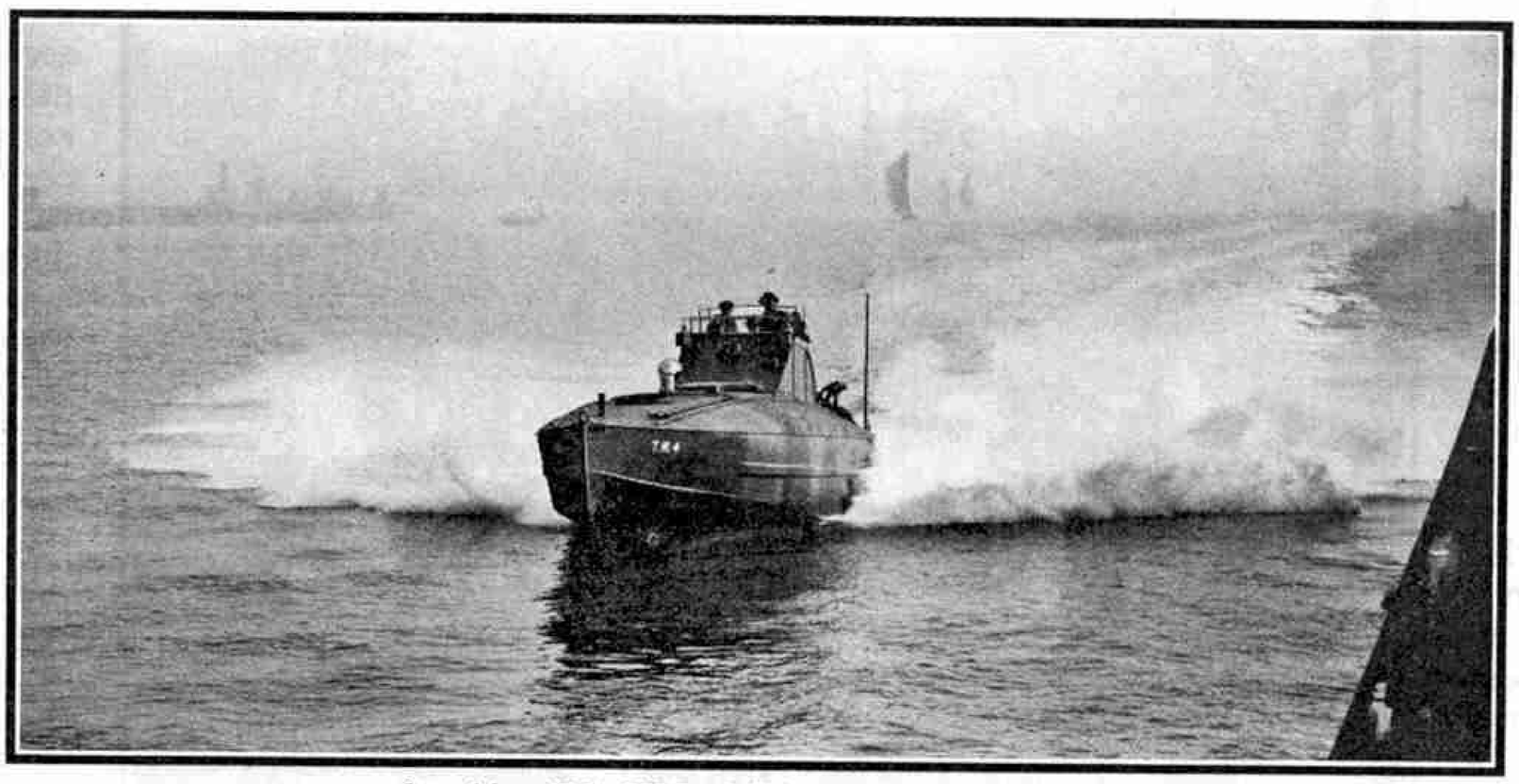
The firm were instructed that the greatest possible secrecy must be maintained, as it was considered that successful operations with the boats would depend to a great extent on the enemy being ignorant of their existence. Arrangements were made to build the boats on an island in the Thames, and skilled workmen from the dockyards were loaned to assist in the work. No motors existed that were suitable, and therefore new designs were prepared, and the motors were put in hand at the firm's Basingstoke Works, where the torpedo gear and fittings also were made. The first three boats were completed in April, 1916, and were inspected by the Sea Lords, who considered them successful in every way.

As a base, the South Eastern Railway Company's pier at Queenborough had been decided upon, and the officers who volunteered for service on these boats lived for some time on the pier. Even in Sheerness it was not known what the boats were for, as their running for training purposes was carried out very largely at night. It was decided that the crew should consist only of two officers, and with a view to their becoming thoroughly conversant with the motors they all spent a month or so at Basingstoke in seeing them built and put through their trials. Very few mechanics with a knowledge of motors of more than 250 h.p., of more or less an aeroplane type, were available in the country generally, and there were certainly none in the artificer branch of the Navy. Thus the officers had not only to get accustomed to handling the boats and firing their torpedoes under novel conditions, at speeds of well over 30 knots in the dark, but also a staff of artificers and mechanics had to be trained to look after and maintain the motors. The officers who volunteered to serve were largely recruited from the Harwich Force.

Subsequently an experimental boat was built of twice

the power, designed to carry two torpedoes instead of one. Trials were carried out with this 55-ft. boat, armed with one torpedo and four depth charges, and as a result the Admiralty decided to build a large number of such boats with all speed. The 55-footers, in addition to two officers, carried two motor mechanics and a wireless operator.

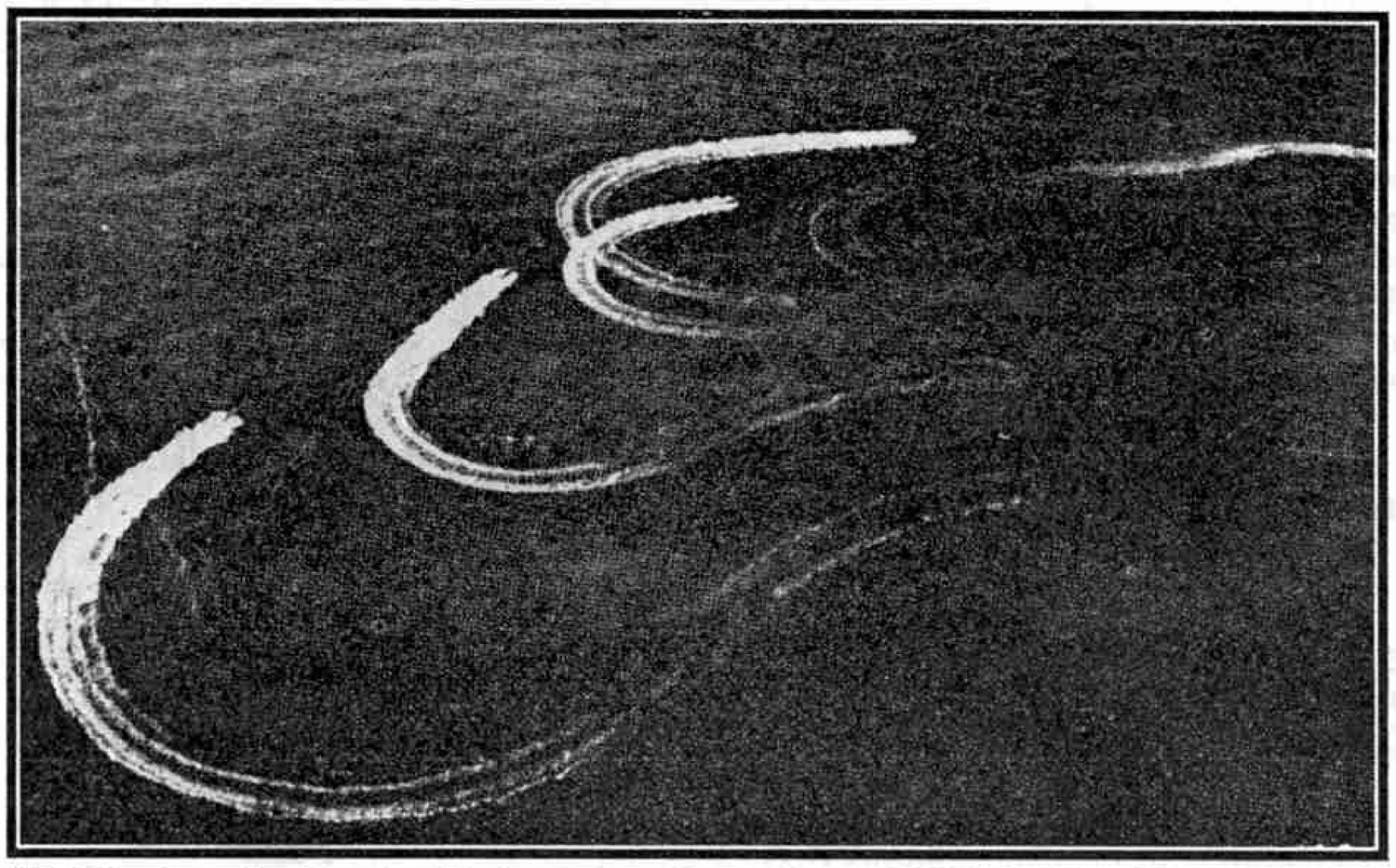
The 55-ft. C.M.Bs. used for anti-submarine work were based at Dover, Portland and Portsmouth. Dover's advance base at Dunkirk was also provided with suitable accommodation for the boats and quarters for the officers. The Dunkirk boats had the opportunity of actions with the German patrol boats and destroyers, and it is reliably stated that the German naval authorities were in utter dread of them, never knowing when to expect them. The German motor patrol boats, or "P.M.Bs." as they were called, never ventured out at night, or when the weather was the least bit bad.



One of four 55-ft. C.M.Bs. built for the Royal Dutch Navy.

The quickness with which the C.M.Bs. could work up to their speed, which exceeded that of the majority of destroyers in favourable weather conditions, enabled them to escape successfully from the Germans after an attack. The aeroplane and the seaplane, however, having greater speed, proved, as was expected, a formidable adversary when met with in daylight.

The blocking actions at Zeebrugge and Ostend have been very fully described as far as the larger vessels were concerned, but it is not generally known what an important part was played by the C.M.Bs. In the Zeebrugge action they were responsible for making the smoke screen, which they effected by running ahead of the other vessels at high speed and emitting smoke clouds from their exhaust by means of a special smoke-producing contrivance. In addition they had to mark certain positions with flares to indicate the right turning point for the blocking vessels. Two C.M.Bs. entered the harbour in the early stages of the operation to torpedo a vessel alongside the mole, while others were fitted with Stokes trench mortars to throw bombs over the mole on to the aeroplane sheds.



C.M.B.s in action with enemy aircraft during the Great War. This remarkable photograph which shows how these boats turn at high speed, was taken by a German airman.

In the second action at Ostend, when the "*Vindictive*" was placed in position, two C.M.Bs. were specially told off to torpedo the ends of the piers to put the guns on them out of action. Others made the smoke screen, and one of them went in ahead of the "*Vindictive*" burning flares to indicate the exact position of the entrance.

It is a remarkable fact that, with one exception, all the C.M.Bs. that took part in the blocking actions succeeded in getting away, although many of them were battered and war-worn, and had numerous officers and men wounded; and there were many instances of extraordinary escapes from death.

Mine-laying hardly seems the kind of work that these small craft would be expected to undertake, but they were used very effectively to lay mines where the ordinary mine-laying vessels could not go. They were enabled by their shallow draught to pass safely over enemy minefields, and by their high speed to approach enemy waters unexpectedly.

The principal details of the larger type of C.M.Bs., 1915-1920, were as follows. Length 55 ft.; beam 11 ft.; speed over measured mile 40.4 knots; speed on two hours' run 38 knots; horse-power 750. They carried a crew of five, two 18 in. torpedoes, and sufficient fuel for a five hours' run.

Before the Armistice the cruiser "*Diamond*" had been fitted up as a carrying vessel for C.M.Bs., and six 40-footers had been sent to the Eastern Mediterranean, but no opportunity occurred to employ them there. With the opening of the Dardenelles it was decided to send these boats to Batoum and then by rail to the Caspian Sea to augment the flotilla that had been improvised by fitting up commercial vessels as gunboats. In addition to the first six boats six others were sent out under the command of Commander Robinson, V.C., R.N., with several of the original C.M.B. officers; and after an adventurous 600-mile railway journey from Batoum, during which the officers had to work the train to a great extent themselves, they arrived at Baku. At this time it was difficult to discover which of the Russians were friends and which enemies, but all seemed alike in their determination to appropriate the gear and stores belonging to the boats. In very trying weather conditions the C.M.Bs. succeeded in causing the surrender of a number of Bolshevik vessels, without actually torpedoing any of them, but by simply exploding a depth charge in their vicinity. When the Caspian had been cleared of Bolshevik ships the boats were handed over to the friendly Russians.

In the meantime active operations had been going on on the Archangel front, and it was decided to send a flotilla of 55-footers there. It was considered that there would be no opportunity for these boats to use their torpedoes, and they were fitted up with six Lewis guns and portable bullet-proof protection. The expedition had to be recalled, and beyond a certain amount of fighting, part of which was done on shore after landing their machine guns, the C.M.Bs. had no great opportunity of distinguishing themselves.

While the fighting on the Caspian and the Archangel fronts was coming to an end, it was known that there was still a British squadron somewhere in the Baltic, and that a blockade was being maintained to prevent the Bolshevik fleet from coming out of Petrograd Bay. The first incident to attract public attention in the Spring was a report coming through Finland that the Russian cruiser "*Oleg*" had been sunk. It was not known until some time later that she had been attacked by Lieut. Agar in one of the 40-ft. C.M.Bs. while she was at anchor outside the

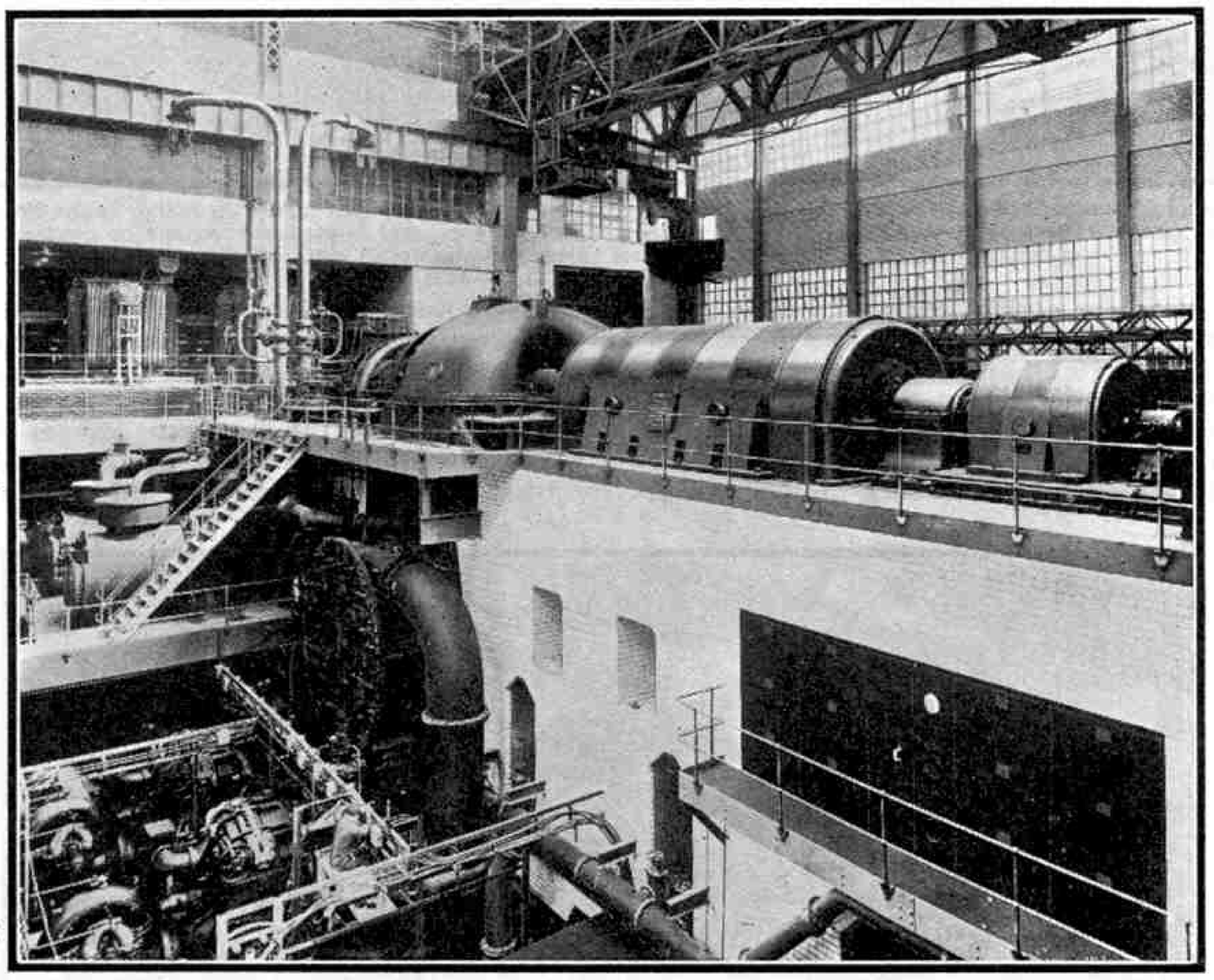
(*Continued on page 461*)

A Power Station in a Dock

by P. J. Robinson, M.I.M.E., M.I.E.E., City Electrical Engineer, Liverpool

DURING the present century the use of electricity has increased enormously, and the growing adoption of this source of power has resulted in this country in the erection of innumerable small power stations each serving a local area. These stations have come into existence independent of each other, and as a result they differ considerably in regard to efficiency and the type of current they supply.

A national scheme controlled by the Electricity Commissioners is now in operation whereby the smaller and less efficient stations are closed down and the energy requirements of the country concentrated on a selected few of the larger and more efficient stations. The number of existing stations that reached the standard of operating efficiency necessary for inclusion in the national scheme was not sufficient to fulfil the requirements, and consequently it was decided to build further "base-load" stations, as they are called, on sites carefully chosen with due regard to load requirements and fuel and water supplies. One of the most interesting of the latter category is the Clarence Dock Power Station, Liverpool, which is included in the North West England and North Wales area of the national scheme. This station is unique in that it has been built on the bottom of a disused dock.



One of the 50,000 KW. Turbo-Alternator Sets installed at the Clarence Dock Power Station, Liverpool. The main stator frame of each alternator is of welded steel construction.

It is 50 years since the first generating station for supplying electricity in Liverpool was opened. The station proved very successful, and by 1886 three others were in operation. These stations were owned and worked by the Liverpool Electric Supply Co. Ltd., but in the year 1896 the business was bought by the Liverpool Corporation, which is still operating and developing it. Two new and more powerful generating stations were built by the Corporation, and the four pioneer stations were relieved of their main responsibilities and converted into sub-stations. One of the new stations, situated at Pumpfields near the centre of the city, was commenced in 1899, and the other, at Lister Drive, at that time on the outskirts of the city, in 1900. A second station was opened at Lister Drive in 1904, and for many years the three stations proved adequate to meet all demands for electricity.

Eventually extensions to the power plant became necessary. The greatest demand for current was in the neighbourhood of the docks and commercial quarters of the city, but no convenient site existed at the time in that district for a power station, and the Corporation therefore erected a third station at Lister Drive. This station is completely independent of the two older Lister Drive stations, with the exception of the necessary electrical interconnections. It was opened in 1926 and is therefore quite representative of modern practice. The plant consists of two 28,000 KW. turbo-alternators with the necessary boilers, three of which are operated entirely by pulverised fuel.

When the discussions relative to the inclusion of the Liverpool Electricity Undertaking as suppliers to the National scheme were proceeding, it became obvious that a further extension to the Liverpool plant would be required.

The efficiency of modern turbine plant depends very largely upon an adequate supply of cooling water for the condensers. At an inland station such as Lister Drive, the water after leaving the turbine is cooled by means of cooling towers, and the same water is used repeatedly. Even with the most modern cooling towers, however, the temperature of the circulating water leaving the towers is not as low as could be desired, and a much more satisfactory arrangement, resulting in a definite increase in the efficiency of generation, is to place the station near a river where an adequate supply of cold water is obtainable, and the water, having performed its function in the condenser, can be returned to the river.

When the question of further extensions arose, therefore, the subject of a river-side generating station was discussed, and a conference was held between the Corporation and the Mersey Docks and Harbour Board, with the result that the Clarence Dock was purchased by the Corporation for the purpose of erecting an entirely new generating station on this site.

The work of emptying and cleaning the dock and clearing away derelict sheds, etc., was commenced in April 1929, and in July of that year the actual constructional work commenced. By August 1931 the first of the 50,000 KW. turbo-alternators was in operation. The magnitude of the work carried out during this period of approximately two years will be appreciated when it is realised that the buildings contain 4,300 tons of structural steel, that there are 55,000 tons of concrete in the civil engineering work, and that the machinery installed weighs 7,000 tons.

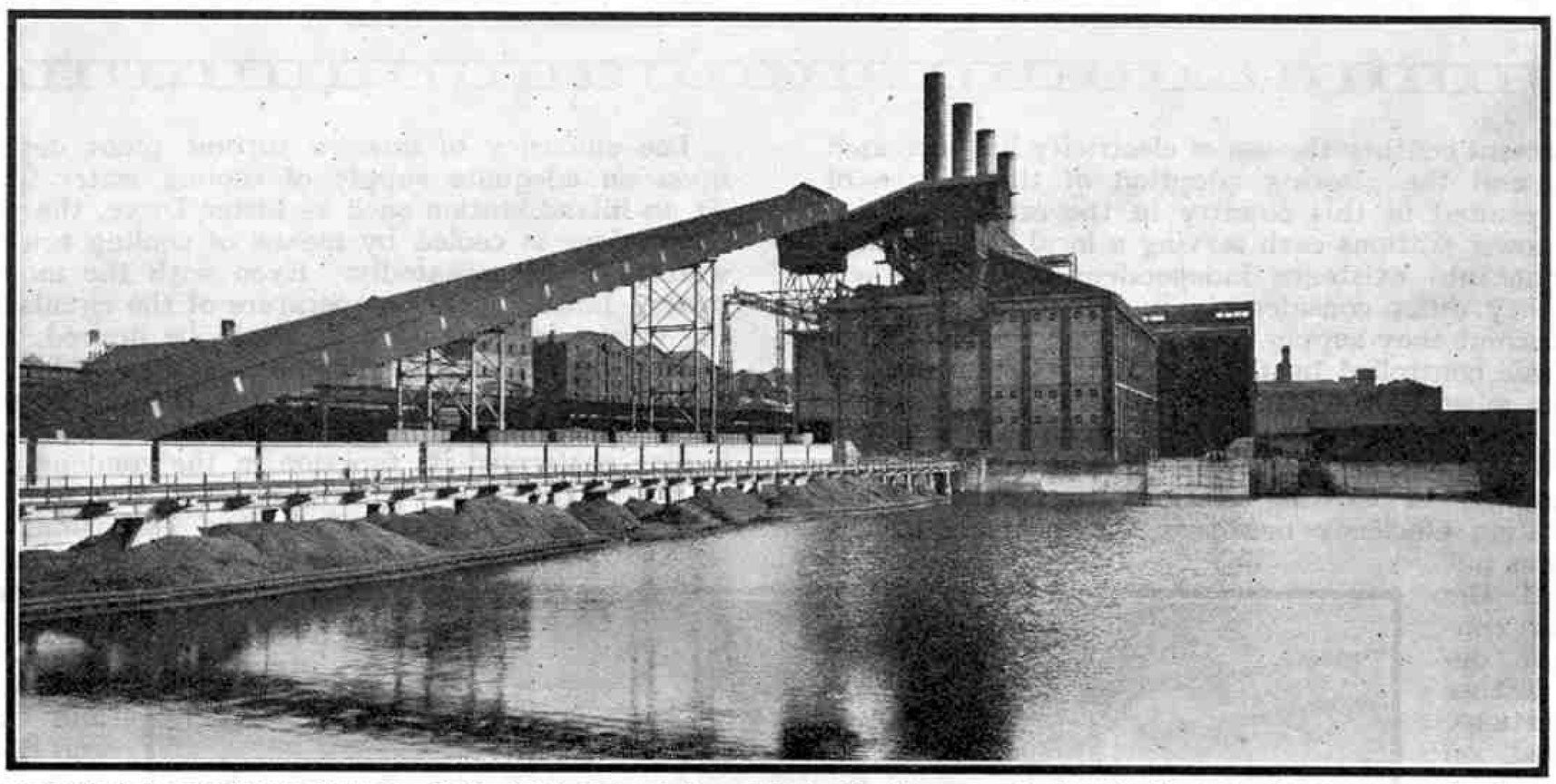
At the present moment the station contains two 50,000 KW. turbo-alternators, one acting mainly as standby to the other, as the steaming capacity of the existing boiler plant is only approximately 70,000 KW. The extent to which future development will be undertaken depends largely upon the output required from the station by the Central Electricity Board for the national "Grid" transmission system.

It is not possible within the limits of this article to describe fully the details of the station, but some of the chief features will be of interest to *"M.M."* readers.

Experience has shown that the average coal used in power stations, if stored in air to a depth of more than about 8 ft. is liable to spontaneous combustion. The ultimate coal storage area available at Clarence Dock is approximately three-fifths of the total area of the dock bottom, the remaining portion being utilised as the site for the present and future generating plant. It is desirable to carry as large a reserve stock of coal as possible, and it was therefore decided to use the full depth of the dock, that is 30 ft., and flood the stored coal with water by means of control valves and pipes connected with the river. By this means it is possible to store 85,000 tons of coal at present, and accommodation for a further 35,000 tons can be obtained by cutting away the dock wall up to the boundary of the Corporation site.

Coal that is required for immediate use is delivered to a concrete silo. This silo is really two rows of ferro-concrete hoppers over the top of which run railway lines. The coal is brought on to these hoppers in 20-ton wagons that have opening bottoms, and by this means the contents are quickly discharged into the silo. Under the silo run horizontal conveyor belts, and the coal is fed on to these through control valves in the bottom of the hoppers. By means of a suitable cross-over arrangement the fuel is transferred on to a rising belt conveyor that carries it on to the top of the Boiler House and into the storage bunkers above the furnaces.

If desired, the wagons, on entering the Corporation site, may be passed over a 60-ton weigh-bridge for checking purposes.



General view of the Power Station. On the left is the coal silo and the inclined conveyor that carries the fuel up to the storage bunkers above the furnaces. The present coal storage area accommodates 85,000 tons, and to prevent spontaneous combustion the coal is flooded with water by means of control valves and pipes connected with the river.

At the present time four water-tube boilers are installed, each having a normal evaporation capacity of 160,000 lb. of steam per hour at a pressure of 450 lb. per sq. in., and total temperature of 750°F. Spaces have been left in the superheaters for the inclusion of further tubes, and by this means, if it is decided in the future to do so, the total temperature of the steam may be raised to 825°F. As the behaviour of metals under high temperature conditions is somewhat problematical, it has been considered advisable to operate the station for two or three years at the lower steam temperature, while observation is kept on the behaviour of the metal of the pipes and valves, etc.

These boilers represent an interesting combination of two methods of firing. For normal operation the fuel is burned on mechanical chain grate stokers. In the side wall of each boiler is a pulverised fuel burner, and these burners are used to deal with rapid increases in steam demand consequent upon sudden rises in load.

A feature of the boilers is the exceptionally high combustion chambers, each approximately 22 ft. 6 in. from the grate surface to the bottom row of boiler tubes. Large combustion chambers were originally introduced in order to ensure complete combustion of the coal particles in the case of pulverised fuel plants, and this accounted largely for the higher efficiency of pulverised fuel boilers over stoker-fired boilers in the early days. It was found, however, that by increasing the distance between the tubes and the grate surface, it was possible to obtain at least as high an efficiency with stoker firing as with pulverised fuel.

The boilers are operated on what is known as the balanced draught system. Air is introduced to the underside of the grate by means of two forced draught fans operating in parallel, and the products of combustion are extracted from the boiler by means of two induced draught fans, also operating in parallel. By means of a suitable damper arrangement it is possible to run one fan of each pair independent of its fellow, with, of course, a reduced boiler output.

With this balanced system it is possible to maintain the pressure in the combustion chamber practically equal to the pressure of the atmosphere outside in the Boiler House, thus reducing the detrimental effect of air leaks, etc. It is however usual in practice to operate the combustion chamber under a slight suction pressure, as this prevents the possibility of "blow-backs," etc., when furnace inspection doors are opened.

The ashes from the boilers discharge into closed reinforced concrete pits, one to each boiler, and are there quenched by means of water sprays. They are carried along channels in the concrete floor of the pits by means of a scraper chain conveyor, and deposited in a large ash pit cut in the rock of the dock bottom alongside the Boiler House. From this pit the ashes are removed by an overhead electric travelling grab crane and dumped into an overhead reinforced concrete bunker, from which they are fed by gravity through chutes into road vehicles or railway wagons for removal.

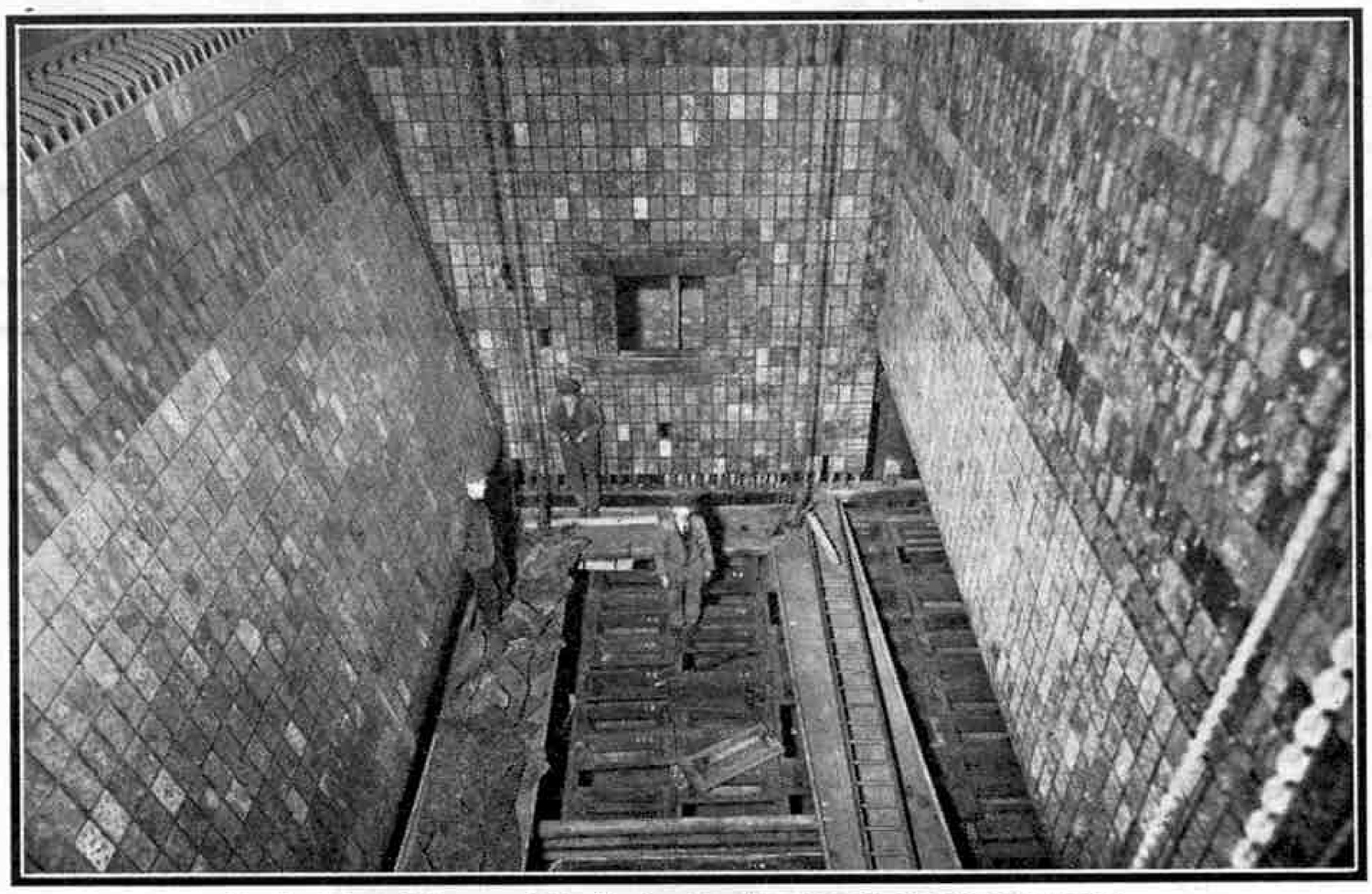
Interior of the Turbine House, showing the two 50,000 KW. Turbo-Alternator Sets.

A further interesting feature of the Boiler House is the adoption of a system of remote control on three of the four boilers, by which means the speed of fans, degree of damper openings, speed of grates, etc., can all be centrally controlled from one panel located adjacent to each boiler. On this panel also are grouped all the pressure, temperature, etc., indicators relating to that boiler, so that the conditions of operation can be adjusted to give the maximum boiler efficiency at any given load. Experiments are being carried out on the fourth boiler by which this remote control is operated automatically.

In connection with the remote control, the method of obtaining variable speed on the fans is of interest. For the sake of simplicity the motors driving the fans are alternating current constant speed machines. Between the motor and the fan is a piece of apparatus called a hydraulic variable speed coupling. This simple but extremely effective piece of mechanism consists primarily of an outer or driven casing, on the inside surface of which is a number of vanes. The casing contains oil, and also an impeller that is connected to the fan. If the casing contains no oil, the driven portion that is coupled directly to the motor simply

revolves and the impeller remains stationary. If the oil is admitted, it forms a driving medium between the driving and driven portions of the coupling, and the slip in speed between these two portions depends entirely on the amount of oil contained in the coupling.

The oil is fed to the coupling from an overhead gravity tank, the height of oil in the tank being controlled by means of a motor-operated weir. A continual circulation of oil takes place, and after having performed its task as a driving medium, the oil is returned to the overhead tank by means of the ejector action of the coupling. By altering the height of the weir on the return pipe it is of course possible to control the quantity of oil in the coupling, and hence the slip between the motor and the fan. The full load slip is of the order of two per cent. The height of the weir is controlled by a small Servo motor, which in turn is operated by a switch on the central control panel on the firing floor, already mentioned.

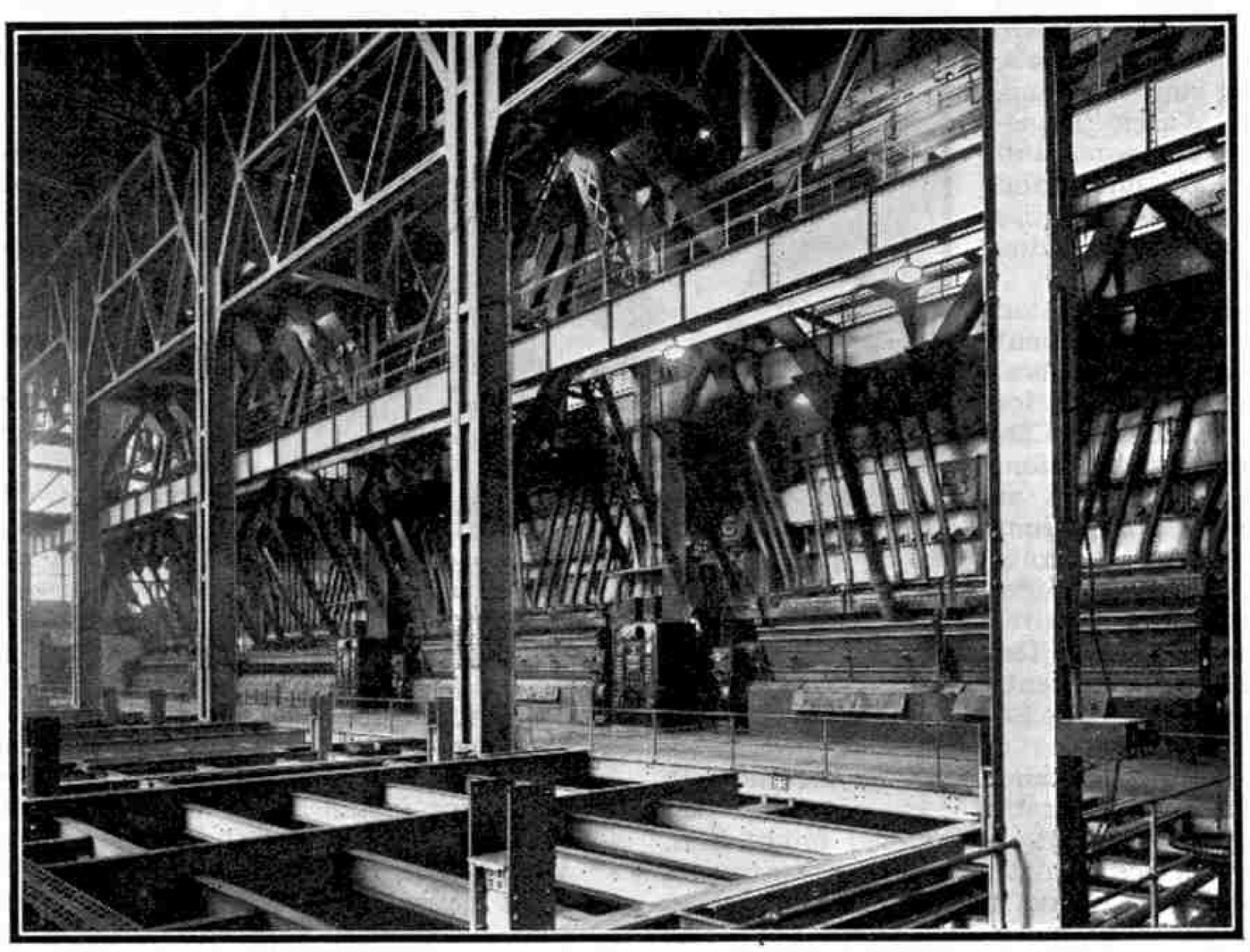


Looking down into one of the Combustion Chambers during its construction.

The boiler feed pumps are located in an annexe between the Boiler House and the Turbine House, and this annexe also accommodates the steam receivers, the main steam pipes, and the interconnecting steam pipes between the turbines.

The Turbine House, as previously stated, contains at the moment two 50,000 KW. 3-phase turbo-alternators running at 1,500 r.p.m., and generating directly at a pressure of 7,250 volts between phases. Mounted on the same shaft as the main alternator is a 1,250 KW. auxiliary alternator generating at 400 volts, which provides power for the operation of the station auxiliaries.

Each complete generating unit is mounted on a reinforced concrete foundation block, and in the base of each block are housed two transformers each capable of handling half of the output of the main alternator. The connections from the alternators are coupled directly to the primary of these transformers, and the secondary connections, which are at a pressure of 33,000 volts, are carried by means of a cable cross-over into the Switch House. This method of housing the transformers in the foundation block of the generating unit is of particular interest and forms one of the unique features of the station.



The four Water-tube Boilers erected in the Boiler House.

There are one or two constructional features of the generating units that are specially noteworthy.

The main stator frame of each alternator is of welded steel construction. This represents the most modern practice, as until about two years ago all stators were cast. By adopting the welded construction a saving in weight of about 16 tons over that of a cast frame has been achieved.

The conveyance of these large machines by rail from the works to the station provided interesting out-of-gauge loads. Each machine was taken in two parts, the stator weighing 86 tons—one of the heaviest and largest loads ever carried by rail in this country—and the rotor 65 tons. The stator was mounted on a truck specially designed by the L.M.S.R. for this type of work. It exceeded the normal loading gauge by about 2 ft. 6 in., and therefore was transported during a Sunday, special arrangements being made for a clear line and the suspension of other traffic. On arrival at the station the plant was unloaded and placed in position on the foundation by the overhead electric travelling crane in the Turbine House, which has a normal lifting capacity of 110 tons.

The transformers, each complete with tank and full complement of oil, and each weighing about 65 tons, were transported to Liverpool by road. At the makers' works they were loaded on to two vehicles specially designed for this class of transport, and on arrival at the station they were unloaded by the Turbine House crane.

The choice of a suitable metal for the condenser tubes was a matter that required considerable attention. As the station is situated on the estuary of the Mersey, the circulating water is salt and somewhat corrosive, and it was consequently very important to determine the material most suitable to resist these corrosive properties. Samples of the estuary water adjacent to the dock at various states of the tide were taken in mid-Winter and mid-Summer, and several proposed tube materials were subjected to prolonged immersion and impingement tests with the various water samples. The extent to which the various samples were affected by these tests determined the ultimate choice of material, and the 7,000 tubes in each condenser were actually manufactured of aluminium bronze alloy.

The cooling water for the condensers is, as already stated, pumped direct from the river Mersey, and of course contains a fair amount of sand in suspension. It is undesirable that this sand should be permitted to enter the condensers, and to prevent this, at the entrance to the suction ducts a large ferro-concrete settling chamber has been constructed with sumps excavated in the rock at the bottom. At the entrance to this chamber are six sluice gates covered by iron gratings that prevent the influx of large masses of floating rubbish, etc. The cross-sectional area of this settling chamber is so arranged that the water velocity in the early stages is very low, and thus the particles of suspended sand, etc., have time to fall to the bottom into the sumps before the water enters the suction ducts. The accumulated silt is removed from these sumps by means of pumps and water-operated ejectors.

The Switch House is a three-storeyed (*Continued on page 470*)

XLIII.—THE LOCAL GOVERNMENT SERVICE

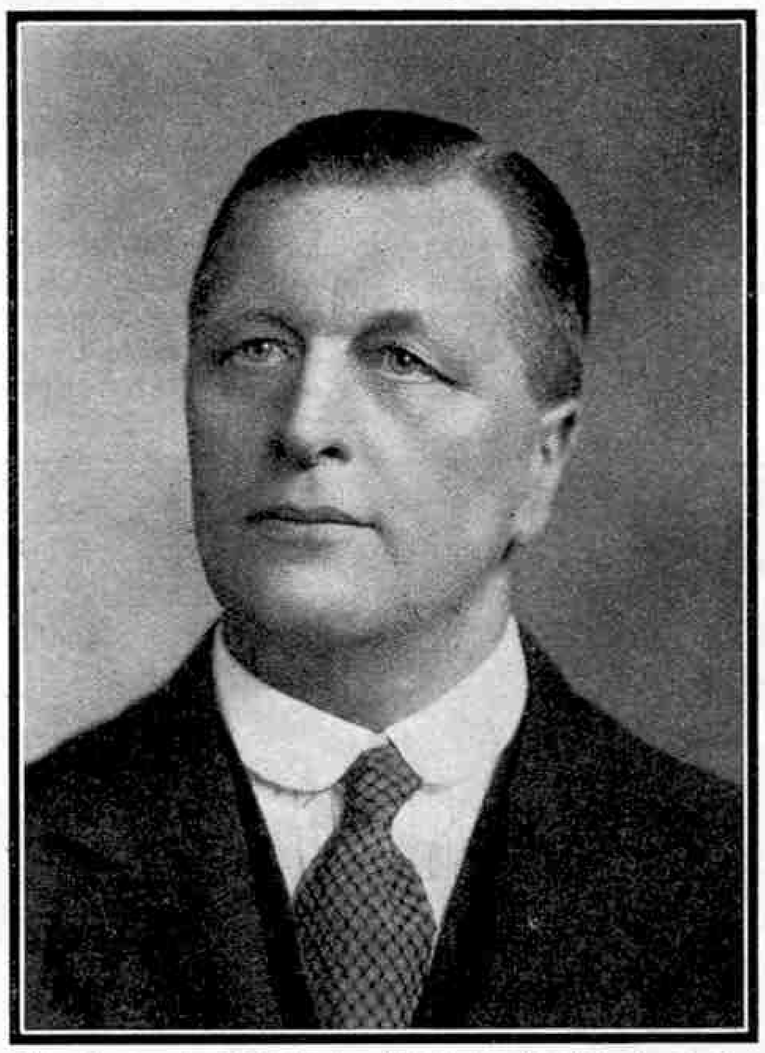
THE Local Government Service can be compared with the Civil Service, for much of the work carried out by its officers is very similar to that done by Civil Servants. The Service has been brought into being during the past 50 or 60 years as the result of the great variety of duties that have been placed upon local authorities by Parliamentary legislation. The Service now offers prospects comparable to those in the Civil Service, and it also possesses certain advantages. One of the most important of these is that as each Council or Borough appoints its own officers, a boy can be certain that while he is a junior it will not be necessary for him to travel to some distant town, as is sometimes the case in the Civil Service. Another point is that the higher positions are not filled solely by seniority, but are usually advertised in the recognised papers devoted to the interests of Local Government officers, and thus there is more incentive for a boy to work hard and to pursue a course of spare time study.

The work carried out by Local Government officers is extremely varied. In a large town there will be most of the following departments: Town Clerk's, Treasurer's or Accountant's, Public Health, Education, Engineer's and Surveyor's, Public Assistance, Cleansing and Lighting, Libraries, Electricity, Gas, Water, Transport, Parks and Cemeteries, Museums and Art Galleries, Weights and Measures, and Markets. In the case of smaller authorities the whole of this work will be divided between three or four departments.

Any boy who desires to reach a position of importance in the Local Government Service must have received a good general education. It is usually necessary also for him to have passed either the School Certificate or the Matriculation examination. The reason for this is that promotion at first depends upon passing examinations of various societies, such as the Institute of Municipal Treasurers and Accountants, any of the recognised engineering institutions, or the Library Association. The men who obtain the highest appointments available are nearly always members or associates of the recognised society dealing with the work of the department concerned. Most of these institutions require all candidates for membership to have passed one of the general educational examinations just mentioned, and thus a boy who is not so qualified might find, on gaining admission to the Service, that the higher appointments were closed to him. He could of course take the Matriculation examination externally at the University of London, but this is a tedious process, and he would be considerably hampered in undertaking it.

Entry into the Local Government Service differs from that into the Civil Service by the fact that examinations are not held simultaneously all over the country. Actually it is not always necessary to pass an entrance examination, an interview and the production of a Matriculation or school-leaving certificate sometimes being all that is required. There is also in some cases an arrangement between the principal officers of the Service and the headmasters and mistresses of secondary schools by which suitable scholars are put in touch with the authorities when any vacancies occur. Other boys should watch the "*Situations Vacant*" columns of local newspapers, for it is here that vacancies for juniors in the various departments are advertised. If a boy does not particularly wish to enter the department in which the vacancy occurs, this should not prevent him from applying for the position, for once he has started employment it may be possible for him to secure a transfer when a vacancy arises.

In many of the departments it is possible for a boy to learn the work after he has entered. His progress will then depend on the rapidity with which he passes the various necessary examinations, on which his proficiency and suitability for promotion will be judged. At the same time, of course, the general standard of his work will be noted and taken into consideration.



Mr. S. Lord, F.I.M.T.A., F.S.A.A., President of the National Association of Local Government Officers. Mr. Lord is Borough Treasurer of Acton and is a Past-President of the Institute of Municipal Treasurers and Accountants (Incorporated).

Although there is no fixed scale of payment, it is probable that a junior clerk in any of the departments will be started at a salary of between £40 or £50 a year. Regular increases in salary are usually made every year provided that a man's progress and conduct are satisfactory, until a salary of about £200 or £250 is received. It is interesting to note that about 69 per cent. of Municipal officers receive salaries up to £260 per year, and only 14 per cent. above £350. Progress to higher appointments is by promotion only, gained as the result of ability proved and the acquiring of special qualifications. When a responsible position becomes vacant it is usually advertised in such papers as the "*Municipal Journal*," the "*Local Government Chronicle*," and the "*Public Assistance Journal*." Anyone may apply for these positions, but in nearly every case they are filled from inside the Service. This system of advertising responsible positions is a greater incentive than promotion by seniority.

A boy who wishes to become a Local Government officer should make sure of the regulations governing the appointments of juniors in his district by writing to the Town Clerk, or the head of the department that he wishes to enter. In some cases it is necessary to take out articles in order to obtain the necessary professional qualifications, and for these the usual premiums have to be paid, varying according to the size of the department concerned. Generally speaking, a boy gains more experience by working for a small town, for instance one with from 30,000 to 75,000 inhabitants. In a town of this size the actual number of departments is smaller than in a large town, so that the work tends to be less specialised, each department carrying out a variety of duties. In most places there are superannuation schemes for officers, but where such a scheme does not exist, there is no pension on retiring.

Readers of the "*M.M.*" will be most interested in the methods of training of engineers for the Local Government Service, and therefore the rest of this article will be devoted to this aspect of the work. Engineers and Surveyors to local authorities are responsible for the construction and maintenance of roads and bridges, and also for their cleansing and lighting. Drainage, housing, town planning, and the design, maintenance and management of public buildings, is also in their charge, while in some towns the laying out, upkeep and management of parks, recreation grounds and aerodromes is placed in the hands of the department. It will be evident from this list of duties that the Engineer and Surveyor must possess not only wide technical knowledge and

practical experience, but also considerable ability as an organiser and administrator.

The Engineer and Surveyor has a technical staff that varies in size according to the size of the authority, and it may include a deputy engineer, divisional or district engineers, engineering and surveying assistants, and specialists in town planning, architecture, private street works and other matters. The profession of municipal and county engineering thus offers a variety of opportunity. It has a place not only for the man of outstanding administrative ability who is destined to attain to an important chief position, but also for those who are better fitted for close application to technical problems than for the work of control and organisation.

Salaries of engineering officers to local authorities naturally vary not only with their position on the staff, but also with the size and importance of the authorities they serve. A young man who has obtained his professional qualifications and gained sufficient experience, whether as an articled pupil or in a junior post, to enable him to apply for an appointment as a junior engineering assistant, may hope to receive a salary of between £150 and £200 a year. His further progress depends upon his opportunities and his ability to seize them.

The technical training of an engineer comprises theoretical study and practical experience. In some cases a course at a university precedes practical training, and in others it follows. Most boys who take up municipal engineering are unable to take a university course, however, and consequently have to obtain theoretical knowledge and practical training concurrently.

There can be no doubt that the best method of becoming a municipal engineer is to obtain a degree in civil engineering at a university. The course lasts for two or three years, and fees vary according to the university at which the boy becomes an undergraduate. This method is particularly recommended if a "sandwich" course can be pursued, the boy working in a mechanical engineering works during vacations. Some public works contractors and also local authorities will give students opportunities of obtaining practical experience during the long vacation, usually without pay. The experience gained in this way is invaluable.

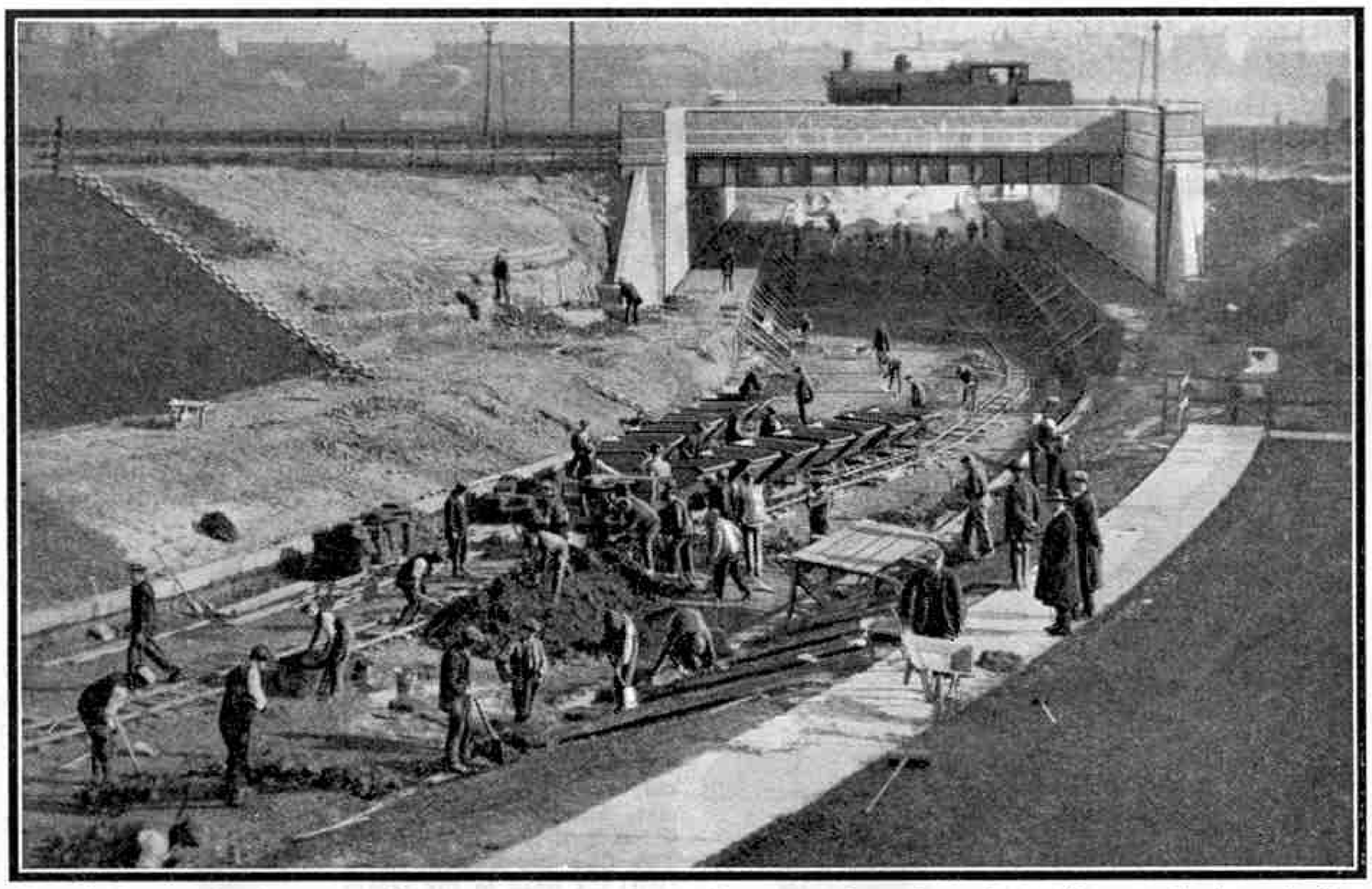
It is unusual for a boy to take a whole-time university course after completing his practical training, although this method possesses certain advantages, the most outstanding being that the student will approach his studies with greater interest, a more practical outlook and a more mature understanding than if he had entered the university on leaving school. There is, however, the drawback that he is interrupting his career at a very important time, severing professional associations that might be useful in securing appointments, and postponing the time when he can begin to gain experience in a salaried post.

By far the commonest way of taking up this career is for a boy to become an articled pupil, or to enter for a period of training as a junior assistant, in a Municipal or County Engineer's office. The normal period of pupilage is for three or four years, and the fees vary according to the standing of the engineer. Articled pupilage introduces a youth at the outset of his career into an office where he is in direct touch with practical conditions, and it lays a definite responsibility on the Engineer to see that the youth receives sufficient and systematic training. A register of City and Borough Engineers who are prepared to take pupils is kept by the Institution of Municipal and County Engineers.

A method alternative to pupilage is for a young man to seek a junior paid post in a Municipal Engineer's Department with a view to acquiring technical knowledge and taking professional examinations. His success will depend largely upon the extent to which he seizes opportunities of gaining information and experience outside his office hours and regular duties. He will receive assistance and guidance from senior officers if he is enthusiastic and industrious, but there will be no one who is directly responsible for his training.

Whether he be an articled pupil or a paid assistant, the youth under training must supplement his practical work by a regular and systematic course of study for the examinations of the Institution of Municipal and County Engineers, whose address is 84, Eccleston Square, Westminster, London, S.W.1. If possible he should study also for the engineering degree or diploma of a university by means of attending university lectures or evening classes.

It is of great importance that entrants to the Municipal Engineering profession should have had a good general education. A thorough grounding in science and mathematics is obviously necessary as is also the ability to write good English. A working knowledge of French and German is an advantage, and if possible, a boy should have had a sufficient introduction to history, economics and the arts to appreciate these factors in his work as a Local Government officer. The Institution of Municipal and County Engineers, the professional society of engineers in the Local Government Service, requires every entrant for its examinations, and every candidate for studentship, to possess a certificate of Matriculation or one of equivalent standard and, as previously mentioned, it is desirable that this examination should be taken while the boy is still at school. If possible he should take also the intermediate (Engineering) examination of a university before leaving school, unless he is proceeding direct to a university, as a boy often finds that his duties do not leave him time to study first for the intermediate and then for the final examination while he is working. This is a point that should be given careful consideration.

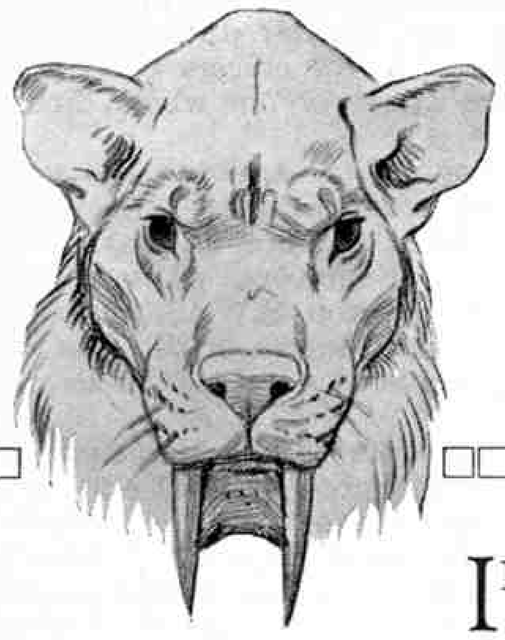


A typical example of the municipal engineers' work—making a roadway through a railway embankment after the completion of a bridge to carry the railway. For permission to reproduce this photograph we are indebted to Mr. Francis Wood, M.Inst.C.E., Borough Engineer of Blackpool.

Articled pupils and junior assistants in the Departments of Engineers and Surveyors to local authorities are admitted to student membership of the Institution, provided that they satisfy certain requirements regarding general education and age. Students of the Institution may sit for what is known as the "*Testamur Examination*" as soon as they reach the age of 20, non-students not being allowed to sit until they are 21. The examination is in general proficiency in the work of an engineer and surveyor engaged in the service of a Local Government authority. After passing this examination they can sit for the County and Highway Engineering examination if they propose to specialise in this branch of the profession, or for the Town Planning examination. On the result of this examination members are elected. Those who hope to qualify for the chief offices should also sit for the Diploma in Administration. This can be taken only by corporate members of the Institution who are at least 25 years of age.

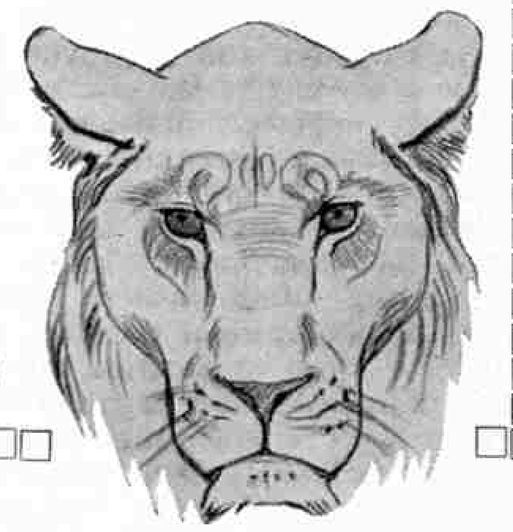
It should be noted that all members of the profession, even those who have taken a university course or have passed such general engineering examinations as those of the Institution of Civil Engineers, should take the examinations of the Institution of Municipal and County Engineers, because these differ from others in being of a more practical character, and they embrace subjects such as law and administration, that are essential to the local government engineer's equipment, but are not included in the syllabus of general engineering examinations.

For assistance in the preparation of this article we are indebted to Mr. L. Hill, General Secretary of the National Association of Local Government Officers, Mr. C. W. Scott-Giles, Secretary of the Institution of Municipal and County Engineers, and Mr. T. Molyneux, M.Inst. C.E., M.I.Mech.E., City Engineer, Liverpool.



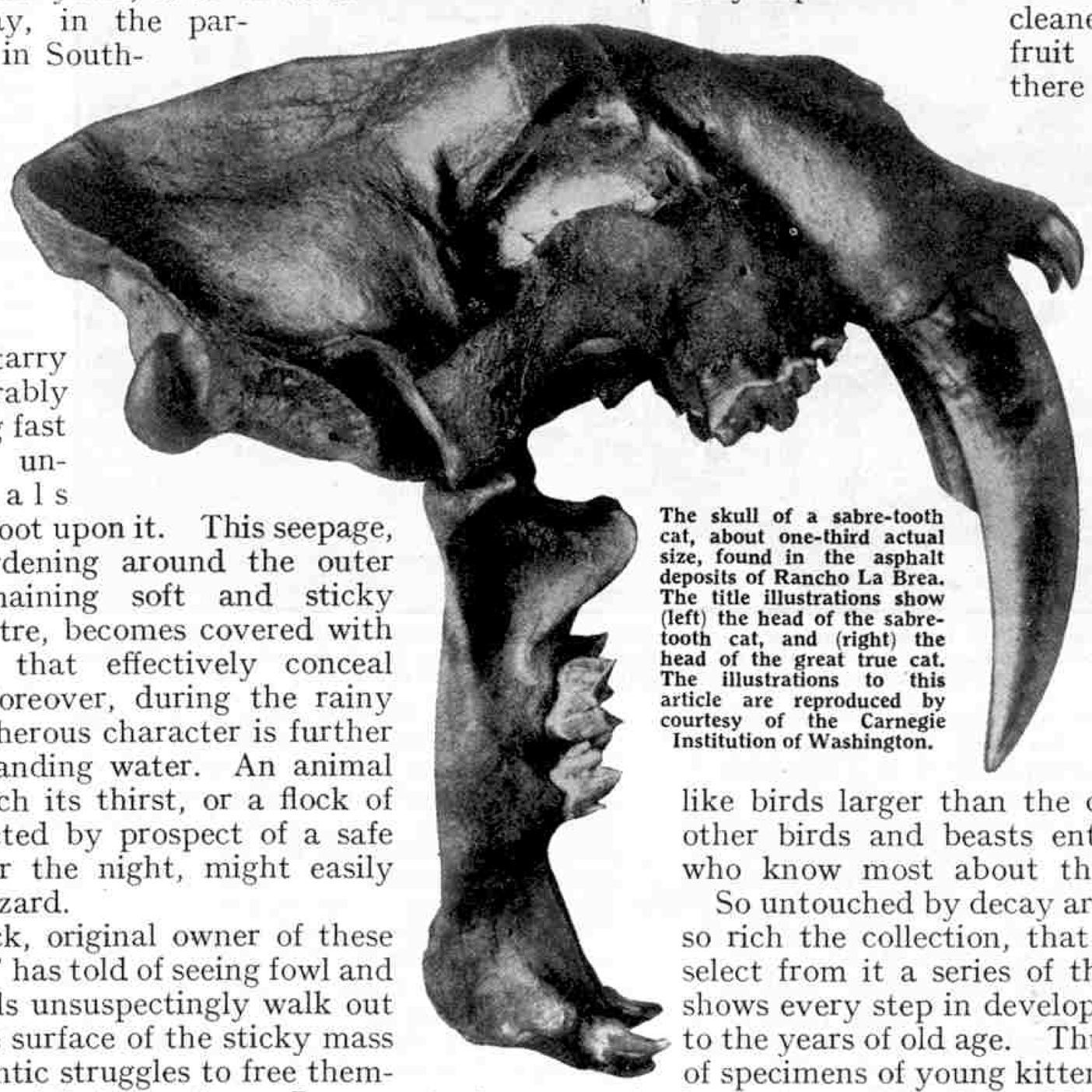
The Cats of Rancho La Brea

Asphalt Pools Preserve Prehistoric Beasts



IN the asphalt deposits located within the present limits of the city of Los Angeles, the interpretative eye of the scientist has discovered the details of a remarkable picture. It is a picture of the wild life that existed thereabouts, apparently in great abundance, one hundred thousand years ago or more.

During all these years, even down to the present day, in the particular location in Southern California called Rancho La Brea, oil has been seeping up from its hidden sources and forming surface pools of an adhesive, tarry substance, admirably suited to holding fast and engulfing unwary animals chancing to set foot upon it. This seepage, drying and hardening around the outer edges but remaining soft and sticky towards the centre, becomes covered with dust and dirt that effectively conceal the danger. Moreover, during the rainy season, its treacherous character is further concealed by standing water. An animal seeking to quench its thirst, or a flock of wild fowl attracted by prospect of a safe resting place for the night, might easily overlook the hazard.



The skull of a sabre-tooth cat, about one-third actual size, found in the asphalt deposits of Rancho La Brea. The title illustrations show (left) the head of the sabre-tooth cat, and (right) the head of the great true cat. The illustrations to this article are reproduced by courtesy of the Carnegie Institution of Washington.

Major Hancock, original owner of these "black springs," has told of seeing fowl and barnyard animals unsuspectingly walk out on the deceptive surface of the sticky mass and, in their frantic struggles to free themselves, gradually sink from view. In turn, he has seen cats, dogs, and even the cunning coyote, attracted by the struggles of unfortunate victims, themselves become entangled to share a similar fate.

Operating in this manner ever since a remote time in the geologic age immediately preceding the present, this natural animal-trap, baited always with living bait, has lured innumerable creatures to their death. Once the animals were engulfed, the organic tissues decayed, leaving the bones disconnected and free to move in the plastic tar. The pressure of deposits from above and the struggles of fresh victims churned the bones about; consequently, on coming to final rest, they formed tangled masses in which the parts of many individuals were mixed in every conceivable way. The excavators came upon pockets in the asphalt beds containing tons of bones, representing the skeletal remains of thousands of individuals and of scores of species, matted together in solid masses.

The tar that caused the death of these animals also served to preserve every skeletal element, including even the tiny bones of the ear. Patient investigators, with accurate knowledge of anatomical structure, have carefully separated the bones from the intermingled masses, cleaned, and reassembled them. As fruit of their painstaking labour there exists to-day in the Los Angeles Museum the most complete representation of the skeletons of Pleistocene animals ever obtained. Among these are skeletons of elephants and camels and of species of horse and bison that are now extinct. There are also skeletons or parts of skeletons of mammoths; mastodons; great ground-living sloths as large as rhinoceroses; gigantic bears differing from every living type; lion-like cats exceeding in size all other felines living or extinct; cats with knife-like fangs; a huge extinct wolf; eagle-like birds larger than the condor; and a multitude of other birds and beasts entirely strange even to those who know most about the animal life of the world.

So untouched by decay are these skeletal elements, and so rich the collection, that Dr. Stock has been able to select from it a series of the jawbones of the cats that shows every step in development of dentition from birth to the years of old age. Thus this series contains a group of specimens of young kittens in which the milk teeth are beginning to function. Then follows a group exhibiting the replacement of the milk teeth by the permanent teeth of maturity. Finally, in still another group of specimens the permanent teeth are broken and worn down, showing unmistakably that the animals had entered the period of old-age decline.

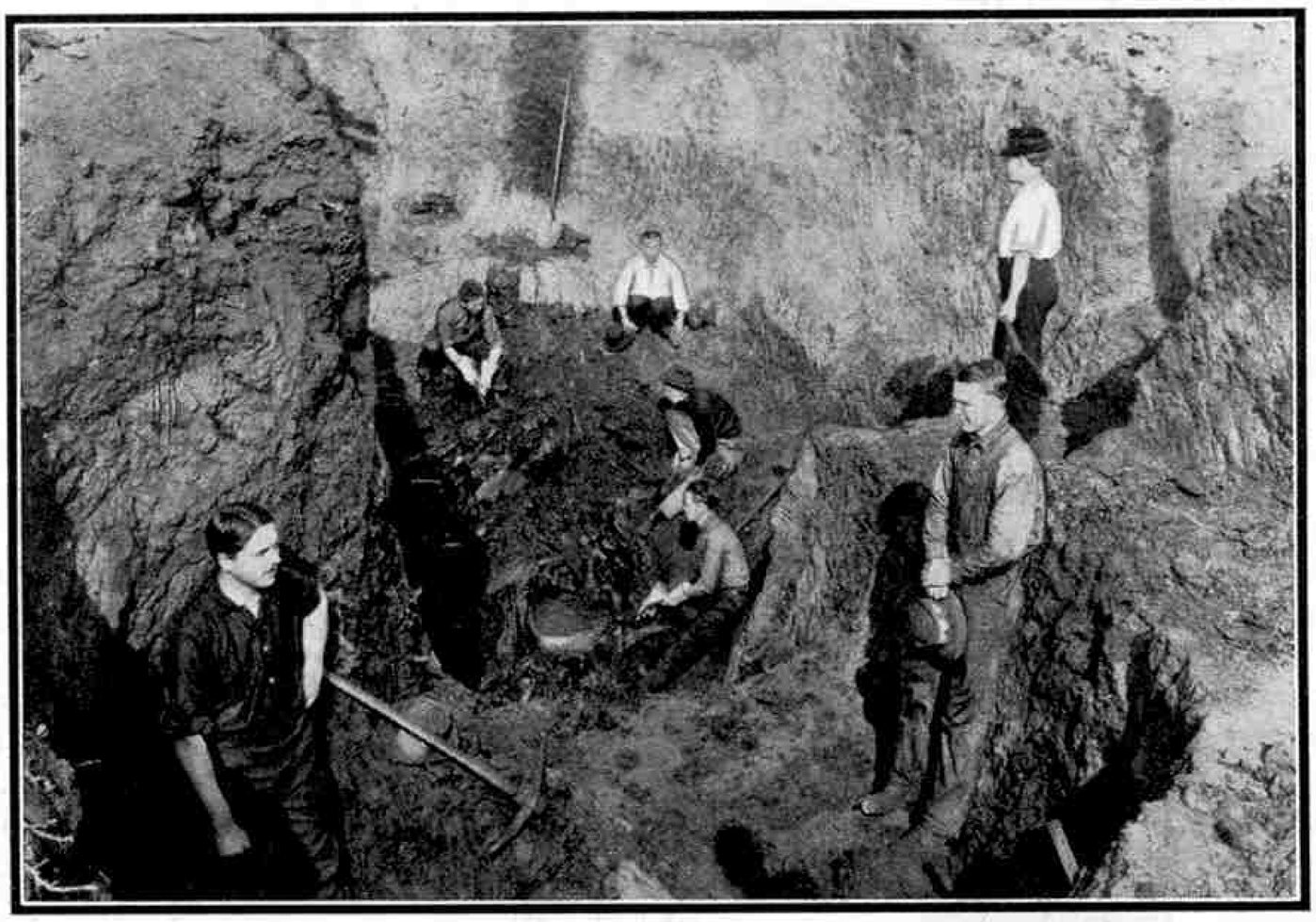
So well preserved are these specimens that many of them speak eloquently of action and of accidents that occurred in the life of the individuals. For example, the cutting and tearing teeth of many of the wolves and lions, as found, are badly worn where they rubbed against each other or against the bones of the creatures on which they preyed. The molars of bison, camels, horses and elephants, are grooved and scored through masticating the great bulk of vegetable food they consumed. So, too, crooked and twisted limb-bones of birds, wolves, and

sabre-tooth cats tell of mishaps and of injuries received in pitiless combat.

A striking word-picture of the kind of story that these age-old records relate is given by Dr. J. C. Merriam in "*The Living Past.*"

"Out of early excavations in the pool there came one day the skull of an ancient tiger with sabres broken and shattered to the roots. The ends of these teeth were worn and blunt, as also the front teeth opposing them in the lower jaw. Through long wear produced by biting upon its food in the form of other creatures on which it fed, the fractured blade of one great tooth had been cut down to a smooth broad surface. Also shattered and splintered, the other sabre showed less wear on the broken end. This second tooth had maintained itself intact long after the other was broken. But at last it fractured in an unduly heavy or misdirected blow.

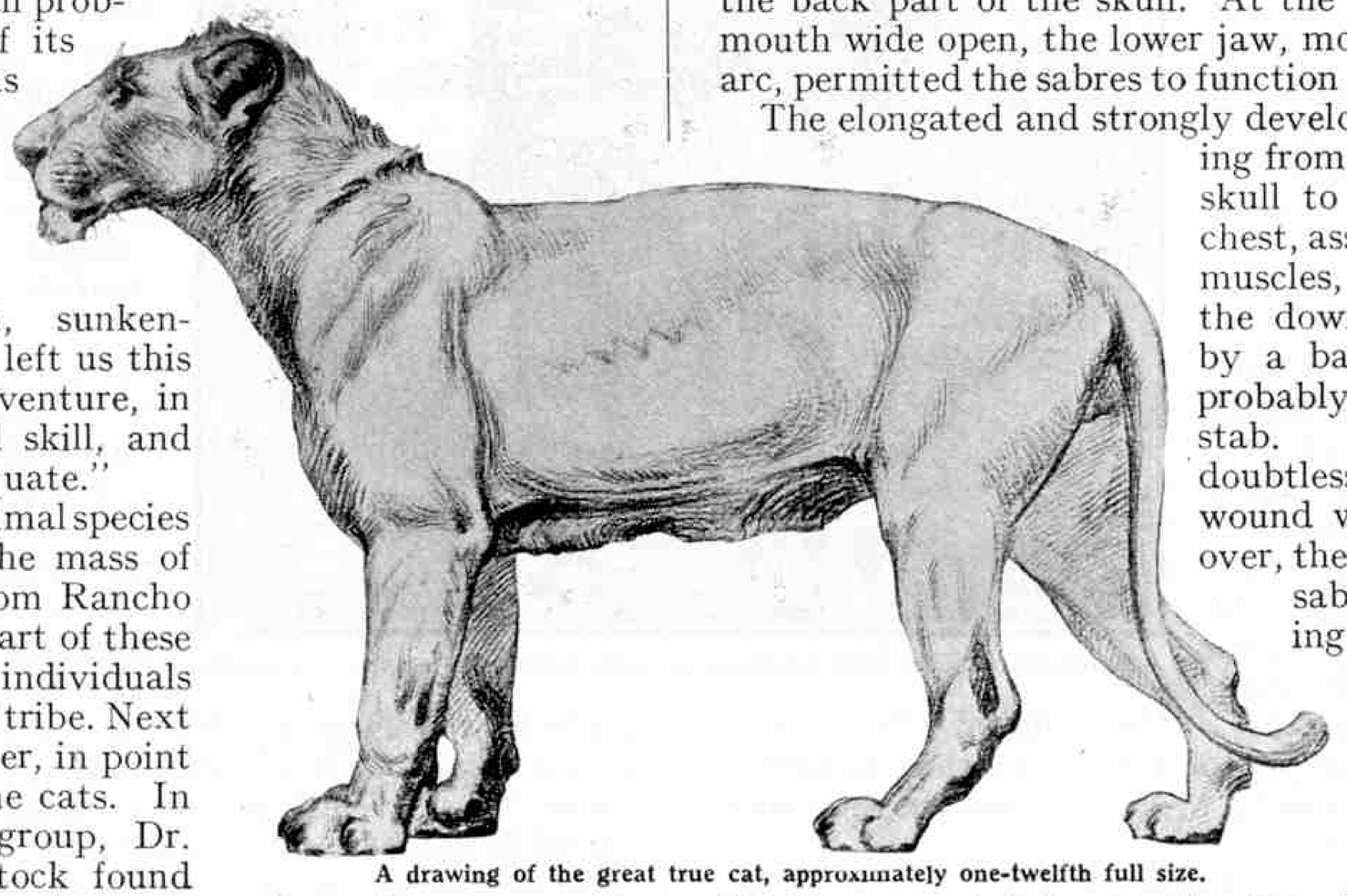
"Instead of carrying death through the swift, sharp strokes of its sabres, the habits of life of this animal were changed, as also in all probability the nature of its food. The tremendous roots of the sabre teeth were shrunken, and the bone around them had shrivelled. It was an old, emaciated, sunken-cheeked animal that left us this record of its last adventure, in which strength, and skill, and courage were inadequate."



General view of the excavators at work in the asphalt deposits of Rancho La Brea. A mass of bones of prehistoric animals is seen in the centre background.

Although many animal species are represented in the mass of material obtained from Rancho La Brea, the larger part of these fossil remains are of individuals belonging to the wolf tribe. Next to the wolves, however, in point of numbers, come the cats. In study of this latter group, Dr. Merriam and Dr. Stock found that although the smaller cats, such as the puma and wildcat, were represented, two great divisions predominated—the sabre-tooth, *Smilodon*, and the great lion-like species, *Felis atrox*.

Judging by the skeletons of more than 1,000 individuals of the sabre-tooth cat, representing both sexes and all ages, that were recovered, *Smilodon*, in adult life, approximated the modern lion or tiger in size, though it probably did not stand as high above ground. Apparently it was not so fleet of foot as they, but it presented a much sturdier front, its limbs and the muscles operating them indicating greater striking and grasping power. Indeed, so great was the development of its foreparts that its hind quarters appear relatively slender, though as a matter of fact the hind limbs are actually comparable in size to those of the largest living felines.



A drawing of the great true cat, approximately one-twelfth full size.

The most striking feature of *Smilodon* is the extraordinary elongation of its upper canine teeth into what amounts to long thin sabres with delicately serrated cutting edges, splendidly suited for stabbing and ripping the flesh of its victims. So greatly elongated are they that they must have protruded below the lower jaw when the mouth was closed.

Many uses of the sabres were at first suggested, varying all the way from aids in climbing trees to use as anchors for holding fast to floating ice. Further study of the skull structure and of the position of the muscular attachments, however, demonstrates convincingly that when *Smilodon* attacked another animal, the head was drawn back by the powerful muscles lodged in the neck, which were in part attached to the back part of the skull. At the same time, with the mouth wide open, the lower jaw, moving through a wide arc, permitted the sabres to function as stabbing weapons.

The elongated and strongly developed muscles extending from the ear region of the skull to the forepart of the chest, assisted by certain neck muscles, were responsible for the downward thrust, aided by a backward jerk, which probably accompanied the stab. With this action, doubtless, an open, jagged wound was inflicted. Moreover, the serrated edges of the sabres assisted in tearing or ripping the flesh, and the scissors-like action of the compressed cutting teeth in the back of the jaws enlarged the cut. With head buried deep in the side of its victim, the backward situation of the opening into the nose permitted *Smilodon* to breathe during the concluding moments of the attack, while the heavy corrugated area, which probably extended over the palate, may have been advantageous in blood-sucking.

In killing their prey the large cats of the present day stealthily approach their victims and, with an impetuous, lightning-like rush, spring for the throat, and having struck hold on with great tenacity. In the case of the highly specialised sabre-tooth

(*Continued on page 461*)

How the Arab Legion Police the Desert

A Picturesque Camel Corps

By Henry H. Marsh

MOST people to-day are familiar with the books of P. C. Wren, "*Beau Geste*," "*Beau Sabreur*," and the rest, which deal with the life and adventures of the French Foreign Legion in out-of-the-way places in the desert. Our cover this month shows a picturesque member of another desert force, quite as brave and hardy as the French—namely, the Arab Legion. Our subject is posing for his photograph near the Arab town of Akaba on the Sinai Peninsula, and a truly romantic figure he looks.

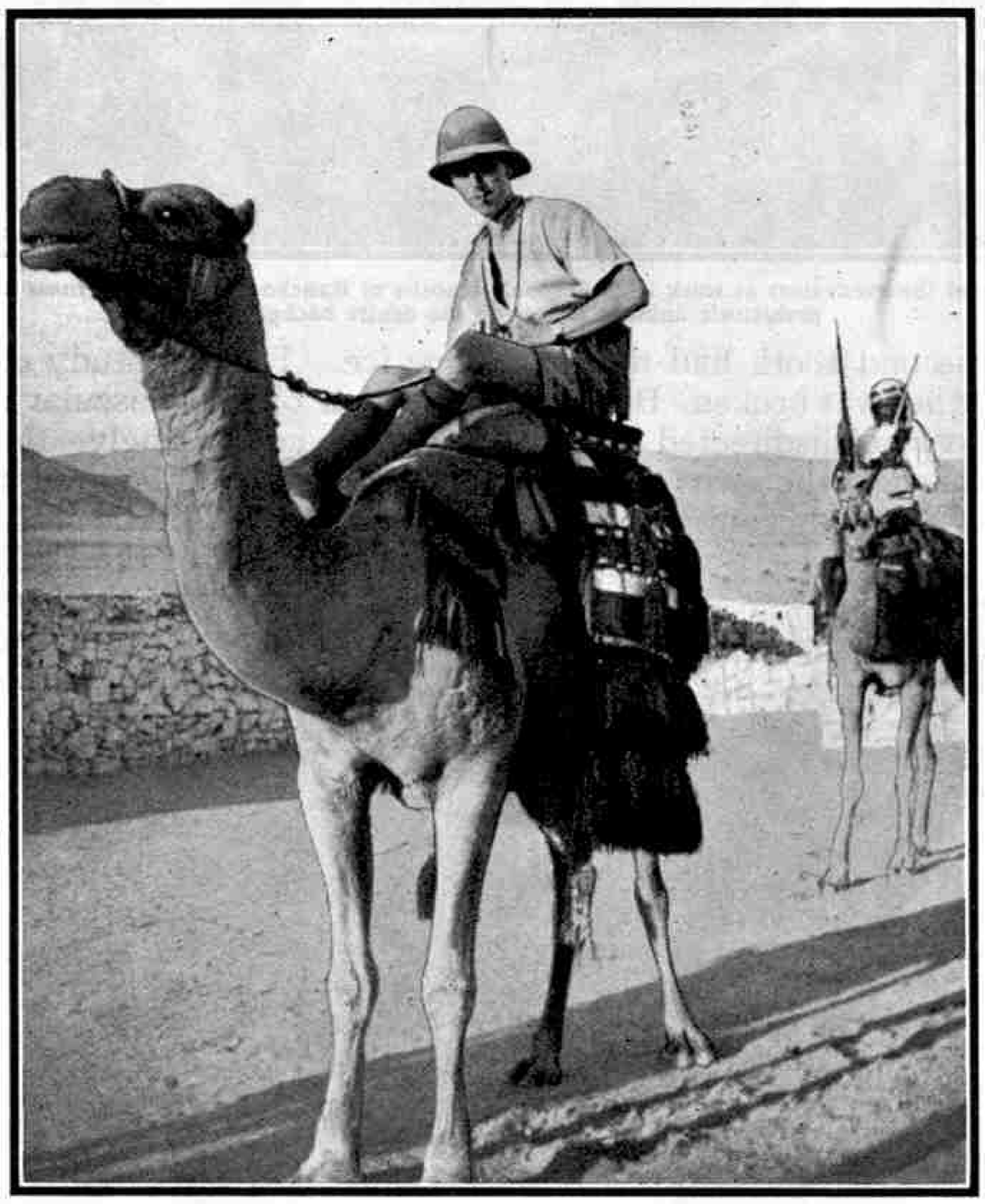
The Arab Legion are the Rural Police of the desert, and their duties consist of keeping law and order among the numerous tribes of Bedouins that periodically infest the region of the Sinai, and rounding up stray fugitives from justice who seek to hide themselves in the desert wastes. There are also village-residing Legionaires known as the Urban Police, who uphold the law on foot in the Arab villages from South Arabia to as far north as Syria. These are a very scattered force, however, working in conjunction with the Royal Air Force whose headquarters are at Amman in Transjordinia.

Both the Urban Police and the mounted Legionaires are armed with modern Lee-Enfield rifles, which have been adopted as being ideal weapons for long-range work. These arms are much to be preferred to the German "Mausers" previously used, which were very unwieldy. The "moral effect" the arms have on all wrong-doers is far greater than would be produced with the common or garden Service revolvers of an obsolete pattern!

At the time of writing, the Arab Legion preserve public security with a total of 860 officers, N.C.O.'s and men, three executive officers being at their head. An Arab Legion Reserve is also maintained. This is an irregular force of Arab police, recruits to which are enlisted in Transjordinia; and it possesses three horse companies, one camel company, and a company in process of mechanisation. The establishment of the Reserve is put at 17 British and 22 local officers, six warrant officers (British) and staff sergeants, and 627 "other ranks," consisting mainly of Circassians, Druses (a wild race of Arabs) and a few Jews. This Reserve supports the local regular police force in cases of serious civil disorder.

Very little is generally known of the Legion's activities, as their work takes them into places as yet almost untrodden by white men. Into the very midst of the warlike tribes of the Druses and Wakfs they go, on errands of peace and lawful tolerance of the delinquencies of these people.

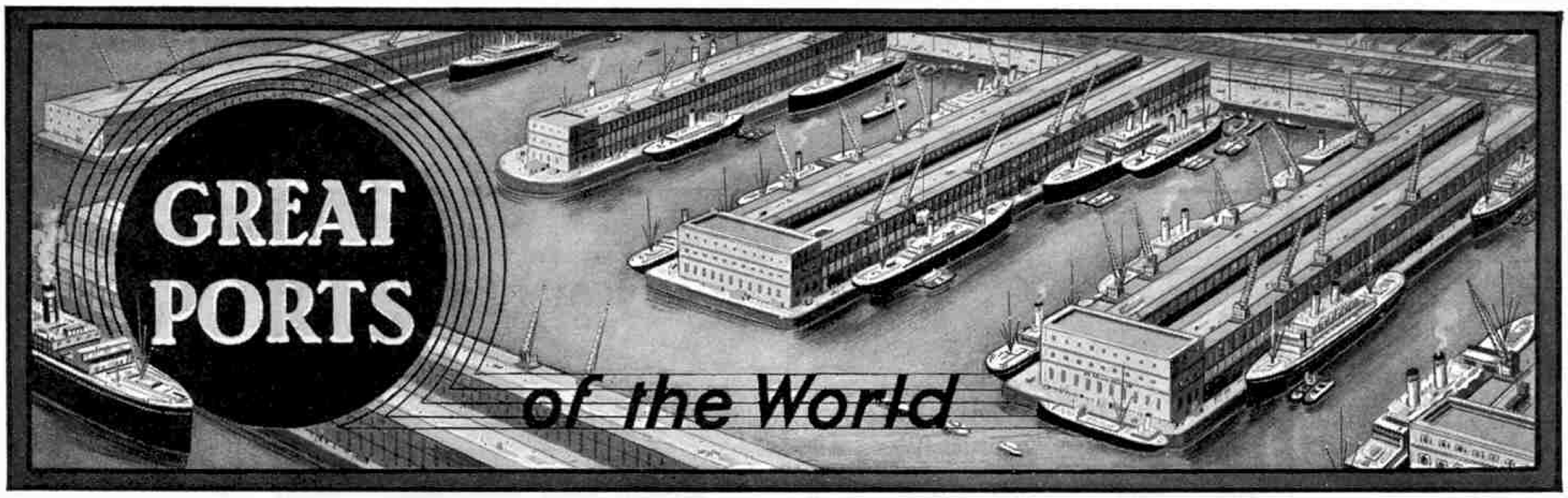
The Legion make a fine picture when they are mounted on their camels, which are far superior to any other kind of transport for themselves and the small baggage they carry. It is well known that the Arabs are susceptible to all colours, especially reds and greens, and the gaudier these are the better they are liked. The saddles of their "ships of the desert" are wool-embroidered in gay colours, and often are tasselled and ornately decorated by Arab craftsmen in the bazaars. In both fighting ability and martial discipline the Legion are a force to be reckoned with, and this is well known by the law-breakers in the remote villages under their jurisdiction.



A British officer of the Arab Legion Camel Corps, followed by an Arab Legionaire.

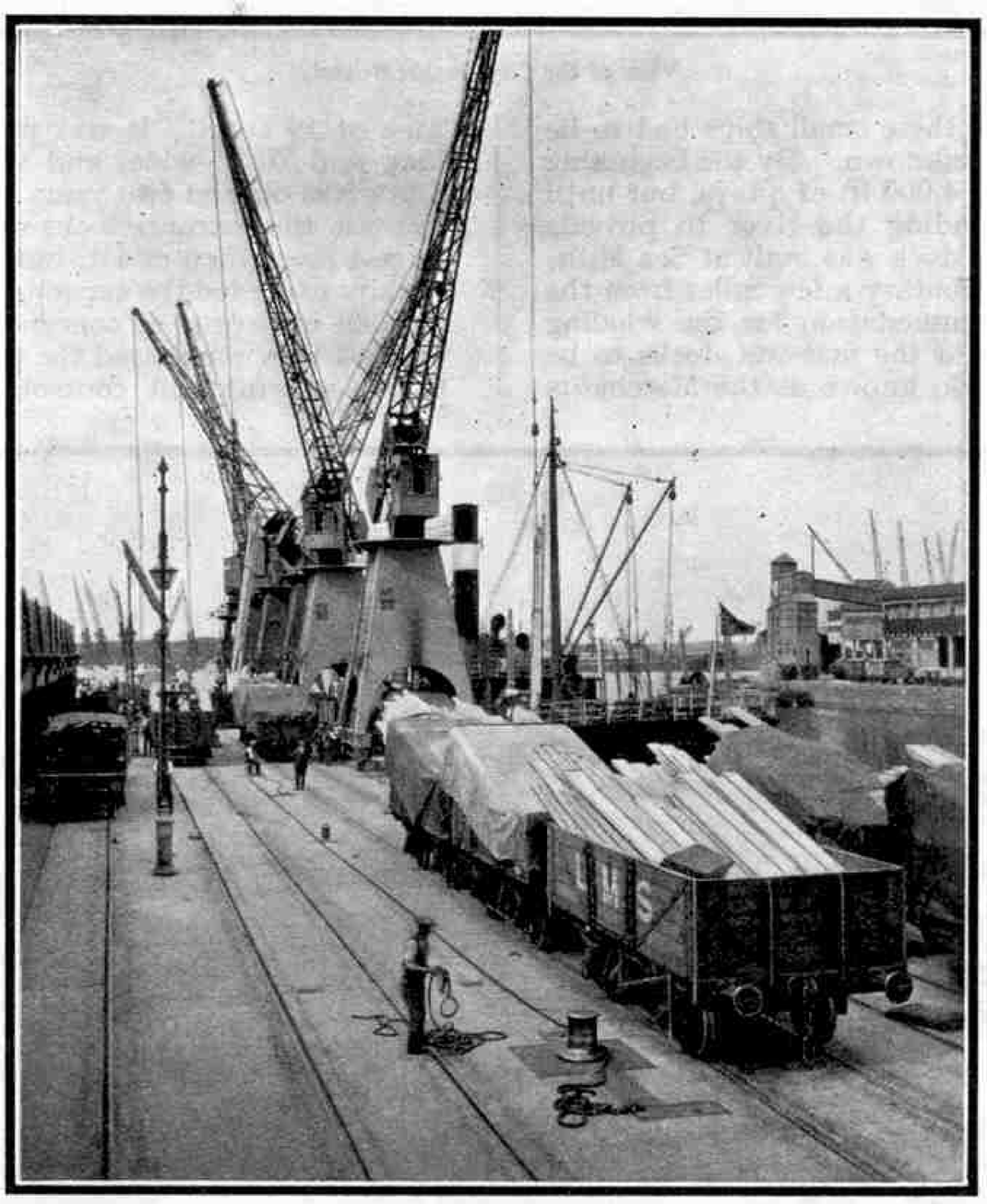
The men of the Legion camp in any particular place that is to be patrolled. Their day begins when the brassy notes of a bugle rouse them from their blankets. After the camels have been fed and watered the men partake together of a frugal meal served in a small tent set aside for the purpose. By 6 a.m., when perhaps the sun is just rising and feebly warming the desert sand, they are ready to start out on their respective patrols. Each camel is saddled and mounted while on its knees; then with a few zig-zag movements of its body it rises to its feet and moves off across the desert, the Legionaire swaying gently in the saddle. Unless anything of importance takes place during the day, dusk usually finds the Legionaires swaying campward again, their rifles "at the ready" across their knees, and singing merry songs in Arabic to the setting sun.

The majority of the Legionaires understand English, and quite a few of them speak the language fluently. This is due to the wise action of the authorities in including the English language in the promotion examinations that are set at different parts of the year.



IV.—BRISTOL

THE origin of Bristol is lost in antiquity, but the mouth of the River Avon appears to have been the terminal port of the Phœnicians prior to the Roman Conquest. During the Roman occupation the main western outpost was centred in the area now occupied by the City of Bristol, which became the market for trade with the countries beyond. The city prospered during the reign of the early Saxon kings, declined after the Danish conquest of Wessex, and was restored by Alfred the Great when he recovered his kingdom. For many centuries after the time of Alfred the Great Bristol was, second to London, the chief seaport of England. The natural property in the port has been vested in the city of Bristol from very early times, and the title was confirmed in writing by a Charter granted by King John in 1188.



Discharging Scandinavian timber at the Avonmouth Docks. The illustrations to this article are reproduced by courtesy of the Port of Bristol Authority.

In the city records of 1239 there occurs the first mention of any artificial works to aid the shipping using the port. These works were carried out on land bought from the Abbot of St. Augustine, and consisted of a diversion of the River Frome to provide a channel for ships, and the construction there of a quay to facilitate the landing of cargoes. This channel was named the St. Augustine Trench, and was about ½ mile long and cost £5,000 to construct. During the reigns of Henry III and Edwards I, II and III, grants, or permits, were made enabling the city authorities to collect tolls on ships and goods. A condition of the grants was that the money obtained was to be spent solely in the repair of quays. These and subsequent grants were only for a limited number of years, however, and the right to levy tolls in perpetuity was not given until the first year of the reign of Edward IV.

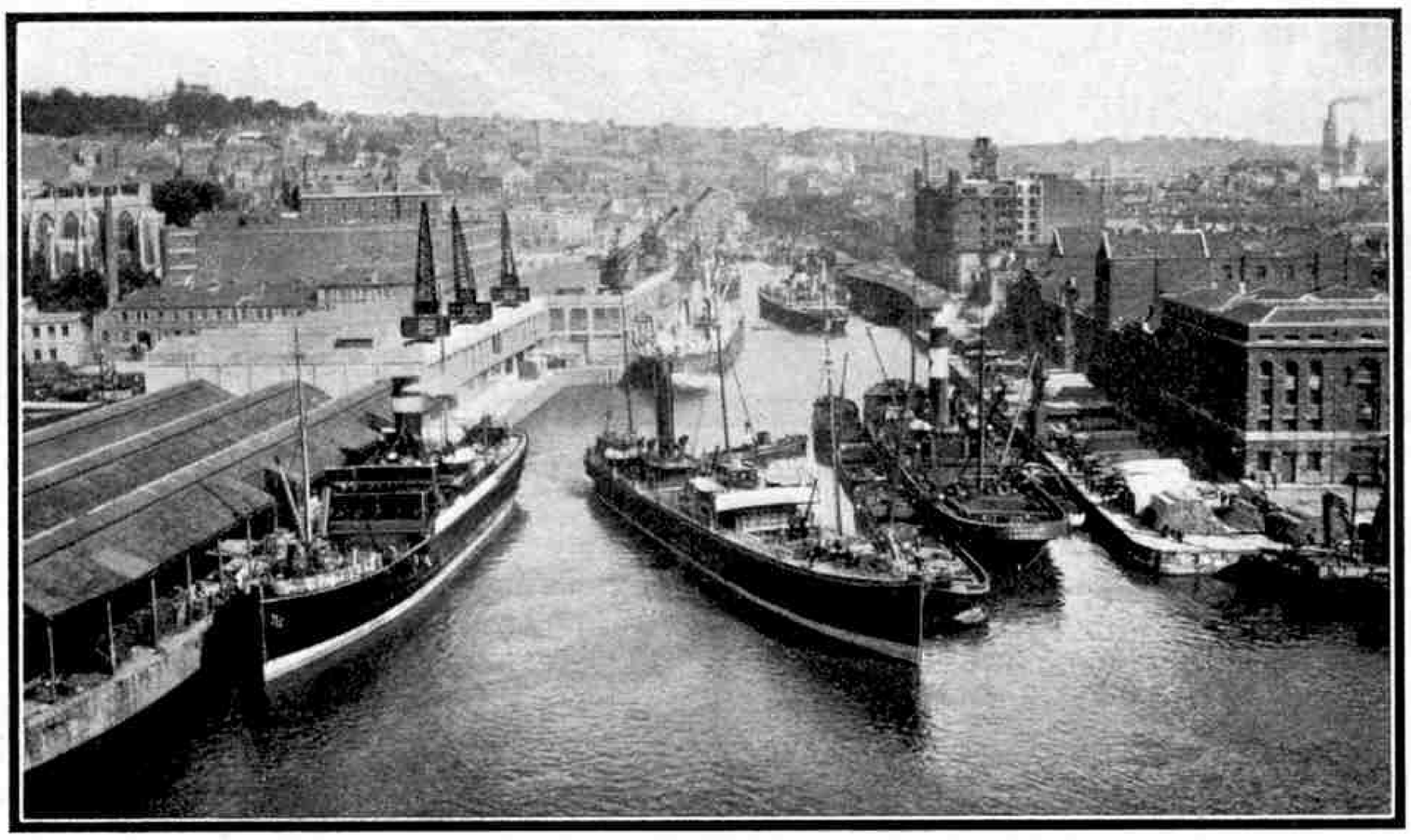
The late 15th century and the 16th century formed a period of great maritime adventure, and Bristol is closely linked with some of the daring voyages, privateering, smuggling and slave trade of those days, for its seamen and merchant adventurers became a tradition. Probably the most romantic and remarkable voyage undertaken from the port was that of the famous navigator John Cabot, in 1497. Cabot, domiciled in Bristol, although a Genoese by birth, was granted letters patent by Henry VII to discover unknown lands. He sailed from Bristol in May, 1497, on the voyage that resulted in his reaching the Atlantic coast of North America and claiming the "new-found-land" for the King. A striking painting by Ernest Board, illustrating Cabot's departure on this eventful voyage, hangs in the Bristol Art Gallery.

Other famous men of the 16th century who were associated with Bristol were Sir Ferdinando Gorges, who has been called the "father of American colonisation," and lived in a great house on St. Augustine's Back where the Colston Hall now stands; and Robert Sturmy, who did much in establishing trade connections with the Far East, and was captured and held in ransom by the Turks. Mention must be made also of Edward Colston, the philanthropist, whose enterprise greatly helped the development of trade with Spain and Portugal, and whose name is greatly revered in the city to-day.

In 1684 the citizens of Bristol and their successors were granted a Charter creating them a corporate body with the title of "The Mayor, Burgesses and Commonalty of Bristol."

The opening up of extensive trade with Spain and Portugal, with the West Coast of Africa, the West Indies and with North America, greatly benefited Bristol. This trade was very varied, wine being brought from Spain, palm oil from Africa, and sugar from Jamaica.

A very lucrative business was the shipment of slaves from the West Coast of Africa to Virginia, from which State the ships sailed for home with tobacco. In those days the laws governing trade at the port gave the burghers or freemen of the city many material advantages, and forbade outsiders to trade there. These rich merchants exercised their monopoly to the full, but they also seem to have combined with it a strong local patriotism, as they established factories in Bristol that provided new sources of employment for the local population. Thus Bristol's prosperity and growth were founded almost entirely upon the ocean trade of the port.



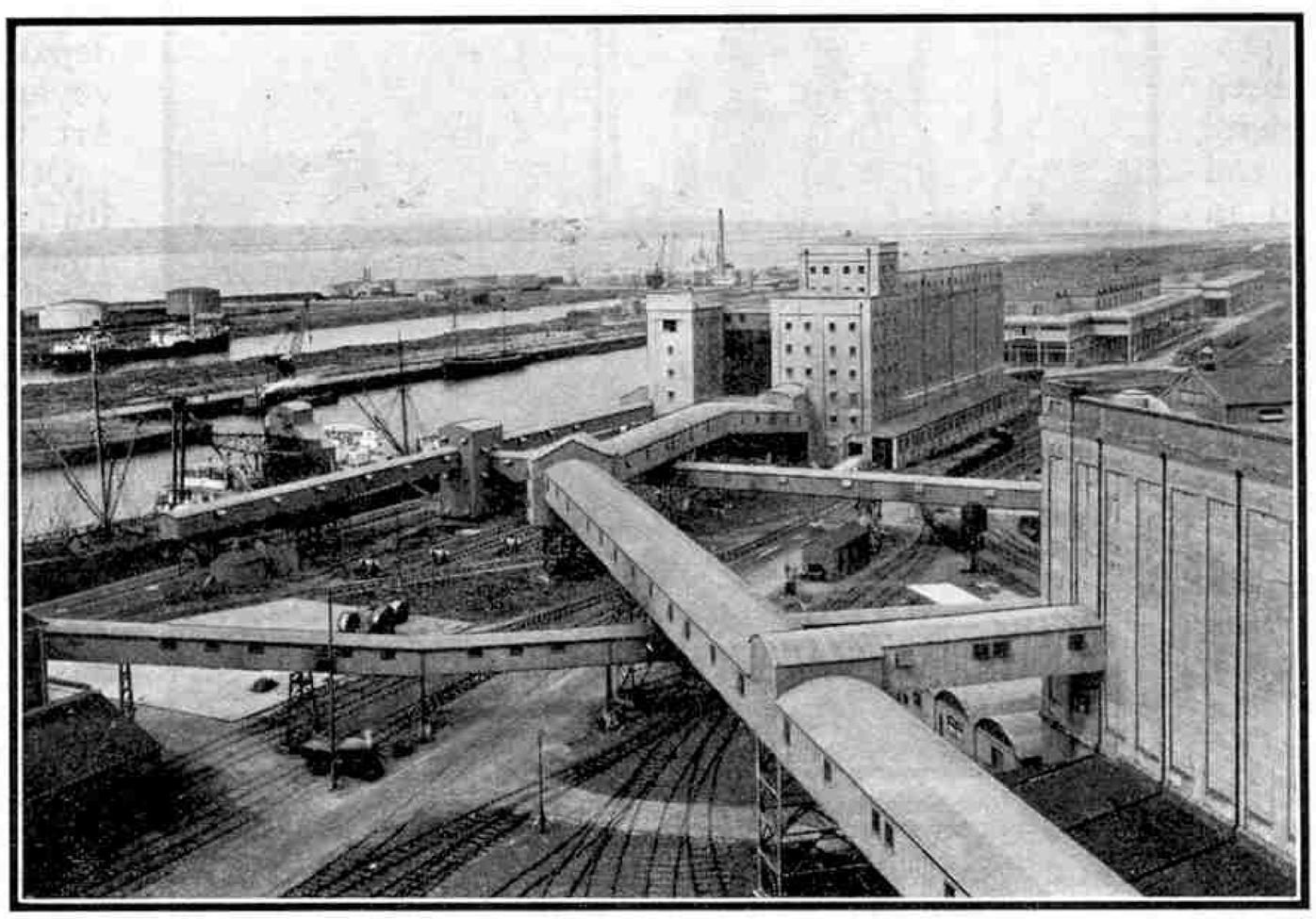
View of the City Docks, Bristol.

There was no need at that time for the elaborate and costly system of docks that subsequently became necessary. The ships in which Cabot sailed to America, and Vasco de Gama, another famous navigator, sailed to the West Indies, were hardly half the size of some of the barges that now ply between Bristol and Avonmouth. At low tide these small ships had to lie aground, as enclosed docks were then unknown. By the beginning of the 18th century the port possessed 4,000 ft. of quays, but until 1712 there was no means of impounding the river to provide a wet dock. In that year, however, a dock was built at Sea Mills, at the outfall of the River Trym—a tributary a few miles from the mouth of the Avon—to provide accommodation for the whaling fleet of the port. This dock was one of the first wet docks to be constructed in England. Another dock, known as the Merchants Dock, was built near Hotwells in 1762, and this dock also was provided with gates so that the water could be impounded and the ships kept afloat.

During the second half of the 18th century schemes for improving the facilities at the port were considered, and in 1803 the Bristol Dock Company, with a capital of £250,000, was formed to develop the City Docks system. An ambitious programme of new works was embarked upon, including the damming of a portion of the rivers Avon and Frome, with entrance locks at Rownham 189 ft. long by 45 ft. wide, and the construction of a new channel for the Avon called the New Cut. The completion of these works gave to the city a dock about three miles long and 83 acres in extent. Many French prisoners of war were employed on the work.

These important improvements were completed in 1809, but owing to the continual increase in the size of vessels, lock extensions became necessary from time to time. Sir Isambard Brunel, the famous engineer who designed and built the great suspension bridge across the Avon Gorge at Clifton, was associated with many of these dock improvements. In 1839 a more commodious lock was built to Brunel's design, measuring 262 ft. in length and 54 ft. in width. These works were carried out during the period 1865–1870, and constituted an improvement allowing the passage of ships up to 240 ft. long between perpendiculars. Important harbour improvements were also effected at this time, including larger and deeper locks at Cumberland Basin; the construction of Prince's, Bathurst and Railway wharves, and the erection of a granary and transit sheds.

The rapid growth in the size of ships during the later part of the 19th century caused great concern at many ports, and Bristol found itself in danger of losing some of its commerce owing to the building of ships that were too large to navigate the river. Opinions differed as to the best means of preventing this loss of trade, and for 40 years a controversy ensued as to the practicability of damming the Avon and converting it into a huge dock, or of constructing docks that could be entered direct from the Bristol Channel. In the meantime private companies built and opened docks at Avonmouth, and at Portishead on the opposite side of the river mouth. The Avonmouth Dock is 2,180 ft. long, 500 ft. wide and has a water area of 19 acres. It was provided with an entrance lock 454 ft. long and 70 ft. wide, and was opened in 1877. The Portishead Dock was opened two years later. At the time they were brought into use the entrance locks were large enough to accommodate the largest ships then afloat, but in less than 10 years the average size of ships exceeded the capacity of the locks. At last the Corporation decided in favour of concentrating dock facilities at Avonmouth. In 1884 they purchased the private docks there and at Portishead, thus acquiring full control of the port.



The overhead conveyor galleries that connect with the various granaries, Royal Edward Dock, Avonmouth.

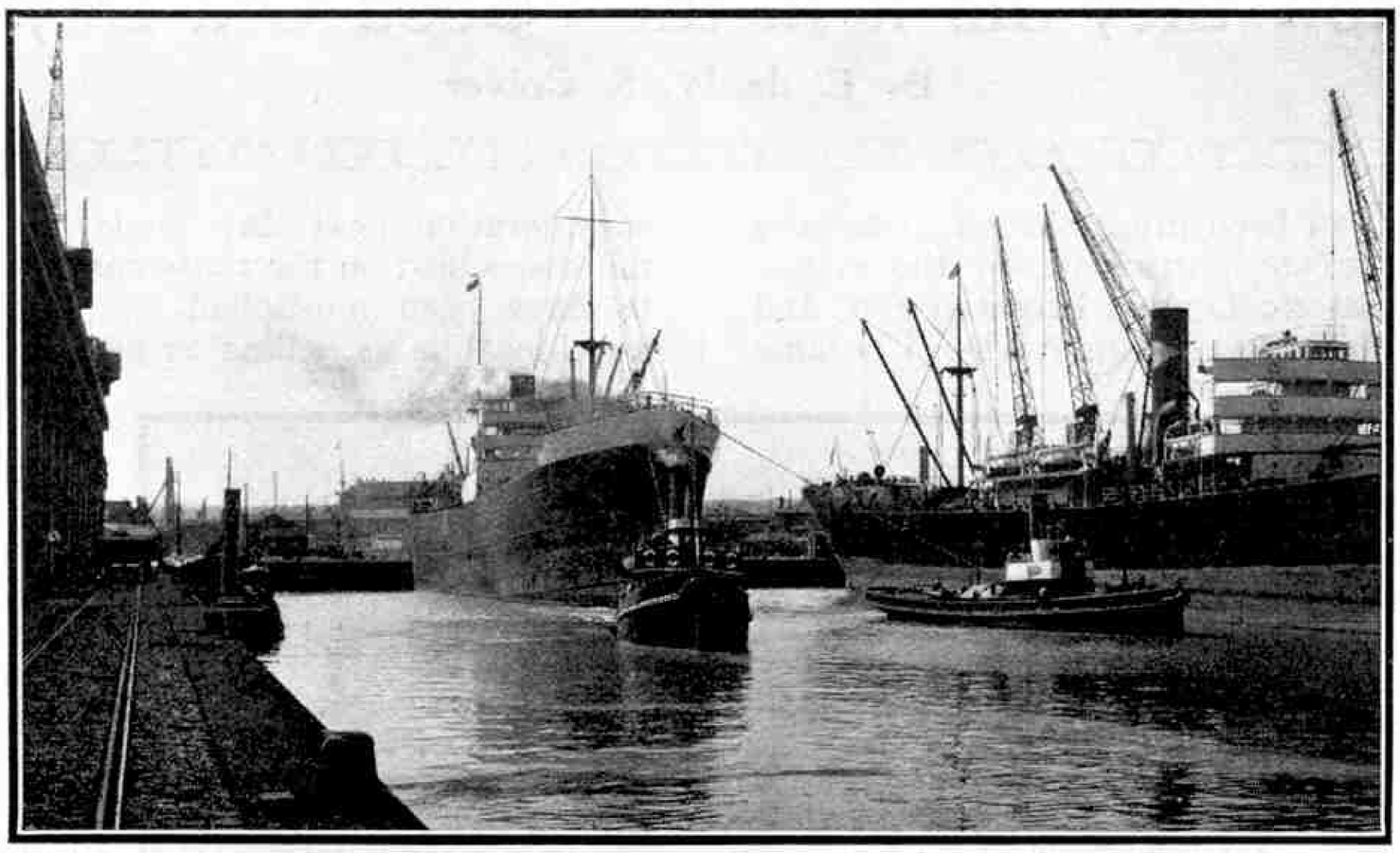
Bristol was the first port in the kingdom to establish a regular steamship service with the United States, and the first voyage to New York was made in April, 1838, by the "*Great Western*," a ship built at Bristol mainly under the direction of Brunel. She was a paddle steamer, and had a length of 263 ft. and a breadth, including paddle boxes, of 59 ft. 8 in. The maiden voyage took 15 days, but the return trip was accomplished in 14 days.

The beginning of the present century found the Corporation of Bristol considering proposed developments at Avonmouth, and in 1900 the city council approved a dock scheme put forward by Sir J. W. Barry and Sir Benjamin Baker. The necessary sanction of Parliament was obtained in the next year, and on 5th March, 1902, King George (then Prince of Wales) cut the first sod in connection with the construction of the new dock. The work took six years to complete, and the Royal Edward Dock, as it is called, was opened by the King on 9th July, 1908. The dock is 3,572 ft. long, 1,000 ft. wide and has a water area of 62 acres. It is provided with 8,367 ft. of quay, and there is an entrance lock 875 ft. long and 100 ft. wide that has a depth of water on the sill ranging from 36 ft. to 46 ft. A graving dock was also constructed parallel with, and the same size as, this entrance lock. Subsequently the entrance lock of the older dock was enlarged to a length of 454 ft., and this lock now has a depth of water over

the sill ranging from 28 ft. to 38 ft.

After the War important additions were made to the facilities of the port, and during the period 1919-21 the western arm of the Royal Edward Dock was completed. Work was then begun on the construction of the eastern arm of the dock, and this was opened by the Prince of Wales on 23rd May, 1928. The eastern arm is 1,700 ft. long, which is sufficient to provide three deep-water berths on each side, and has a water area of 21 acres. Its construction has added a further 3,600 ft. of quay to the dock.

As already mentioned the Corporation are the owners of the entire doc system of the port, consisting of the docks at Bristol, Avonmouth and Portishead, and they are also the Conservators of the port. The administration is vested in a committee of the Corporation under the title of "The Port of Bristol Authority."



A typical dock scene. In this photograph a large freight steamer is shown entering the Royal Edward Dock.

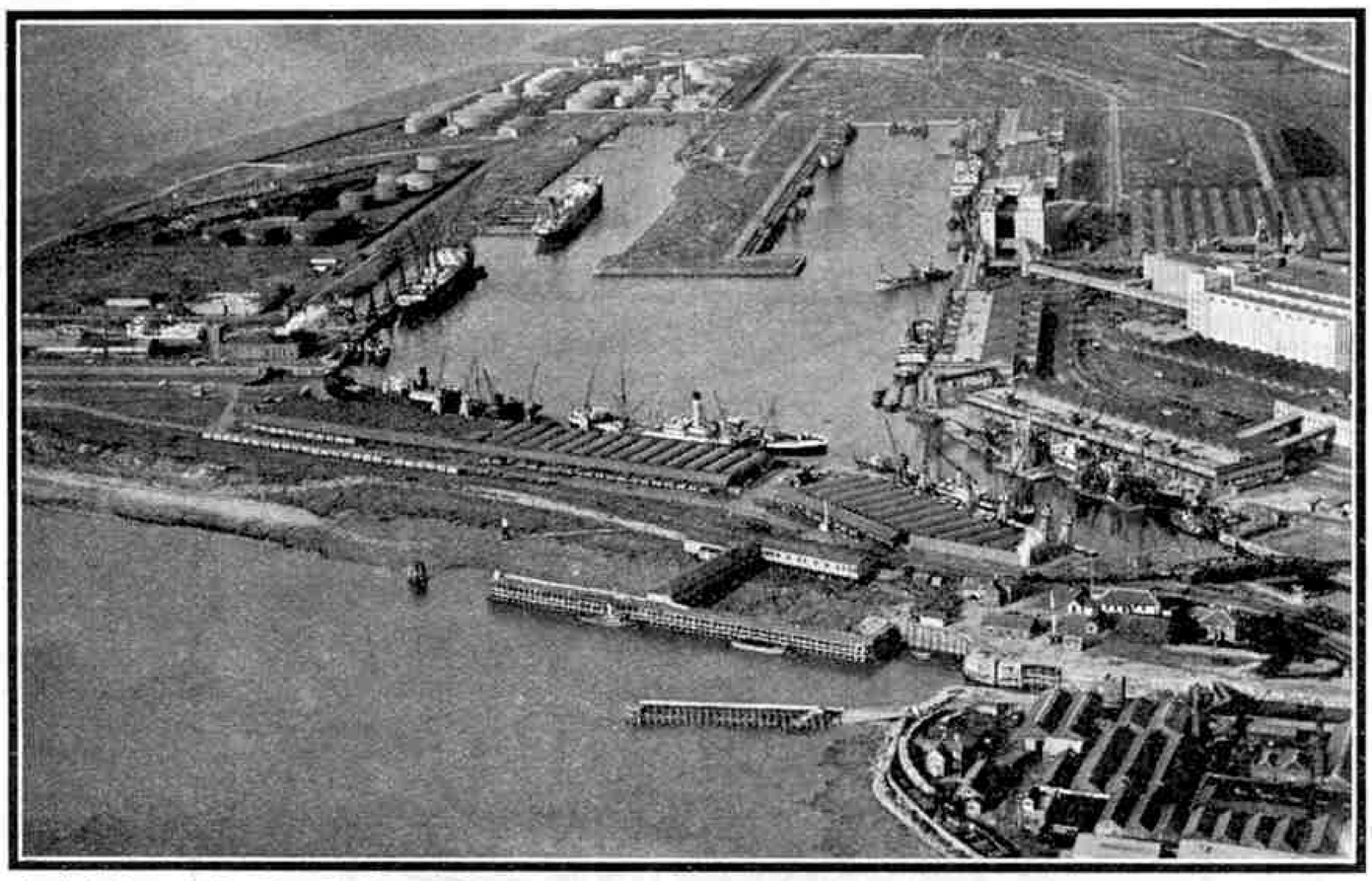
Bristol has long been known as "the gateway of the West," and the port's unrivalled geographical position has been largely responsible for its earning this title, for Bristol is a great distributing centre. Within a radius of 100 miles of the port there is a population exceeding 12,000,000. In addition to the excellent facilities for the transport of goods by rail, the port is conveniently situated for the distribution of merchandise by water to Bristol Channel and other ports, while the Severn navigation provides convenient inland water transport to Gloucester and the Midlands. The total weight of goods brought to the port during the year ending 31st March, 1932, reached the huge figure of 2,443,664 tons, an increase of 160,766 tons over the total for the previous 12 months. The total weight of goods exported from Bristol during the same periods shows a decline, however, the respective figures being 86,341 tons and 103,534 tons.

The importing of grain is a very important branch of the trade of the port, and the quantity imported during the year ending 31st March, 1932, amounted to nearly 1,000,000 tons, exclusive of grain brought by coastal steamers. The reception and distribution of such huge quantities of this commodity has necessitated special equipment, and this has been mainly concentrated at Avonmouth where the latest type of appliances have been installed. The key piece of the elaborate system is the Transit Granary, which has a capacity of 12,000 tons and is built on the silo principle. It is designed to receive grain at an accelerated speed of discharge direct from the ships by means of conveyor bands. There is a fleet of five grain elevators, three of the pneumatic type and two of the bucket type, and all are designed to work from the waterside of the ships. In the eastern arm these are supplemented on the quayside by three travelling pneumatic elevators and one travelling intake conveyor. These shore elevators augment the suction capacity of the floating plant and receive the grain so elevated on to their conveyors, which carry it shoreward and deposit it on to bands in the conveyor gallery that traverses the whole length of the quay.

On arrival at the Transit Granary the grain is raised by bucket elevators and discharged into 5,000 lb. automatic weighing machines, of which there are three. When the grain has been weighed it is elevated to the top floor and there discharged on to conveyor bands running the whole length of the granary above the silos, and thence into the silos through openings in the floor. At the point where the quayside conveyor bands join the Transit Granary the grain can be diverted to another set of conveyor bands that connect with three storage granaries, and when this is done the grain is automatically weighed there instead of at the Transit Granary. The four granaries have a total capacity of 62,000 tons, and are all interconnected by the conveyor bands so that the grain may be moved in either direction at will.

Delivery of grain in bulk from the Transit Granary to river and canal craft is effected through five travelling automatic weighers operating beneath the silos in the west wing. These weighers deliver the grain on to telescopic barge-loading band conveyors that extend over the quay and beyond the edge of the wharf. For rail or road delivery the grain is weighed into sacks and delivered from the loading platforms.

There is a fleet of 14 barges for use when required to speed up the discharge of grain ships, and the floating elevators can fill these barges at the same time as discharging to the shore conveyor plant. When the barges are full they are moved to specially designed craft-discharging berths.



Aerial view of the Royal Edward Dock. On the right can be seen some of the granaries, and in the left background various oil installations.

Bristol is one of the chief fruit importing centres of the kingdom. The green and dried fruit trades that deal with goods from Mediterranean ports are catered for extensively at the City Docks, the transit sheds there being equipped with adequate handling and distributing facilities. Large imports of apples and dried fruits from the Dominions are discharged from ocean liners at the Avonmouth Docks, where there are bonded warehouses with a total capacity of 6,000 tons. The port also ranks as one of the largest banana importing centres in Europe, and about half the total quantity of bananas brought into this country each year is handled at Avonmouth, where in the year ending 31st March, 1932, the huge total of 7,143,206 bunches were dealt with. At these docks an extensive electrical elevator plant has been installed by Elders and Fyffes Ltd., the well-known banana importers, to reduce to a minimum the handling of their imports.

Refrigerated produce is well catered for at the Avonmouth Docks. The Royal Edward Cold Stores, which has a capacity of 500,000 cu. ft., is well equipped for the careful handling of frozen meat, butter, bacon, fresh fruit, etc. It is divided vertically into three sections and horizontally into three floors, making a total of nine chambers in all. The refrigerator plant is of the ammonia compression type. Sling loads of meat are lowered

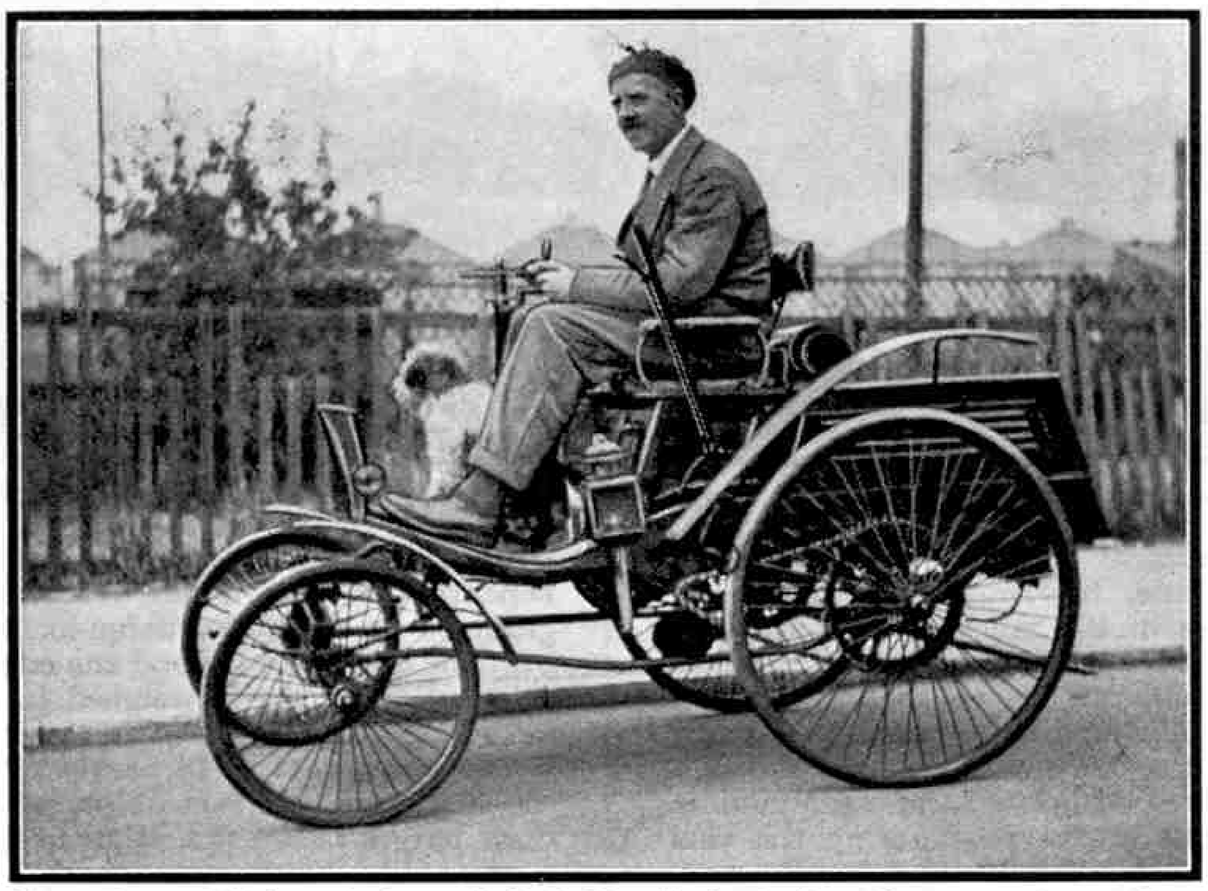
(*Continued on page 470*)

Introducing "Adam"

How they did it in the "Good Old Days"

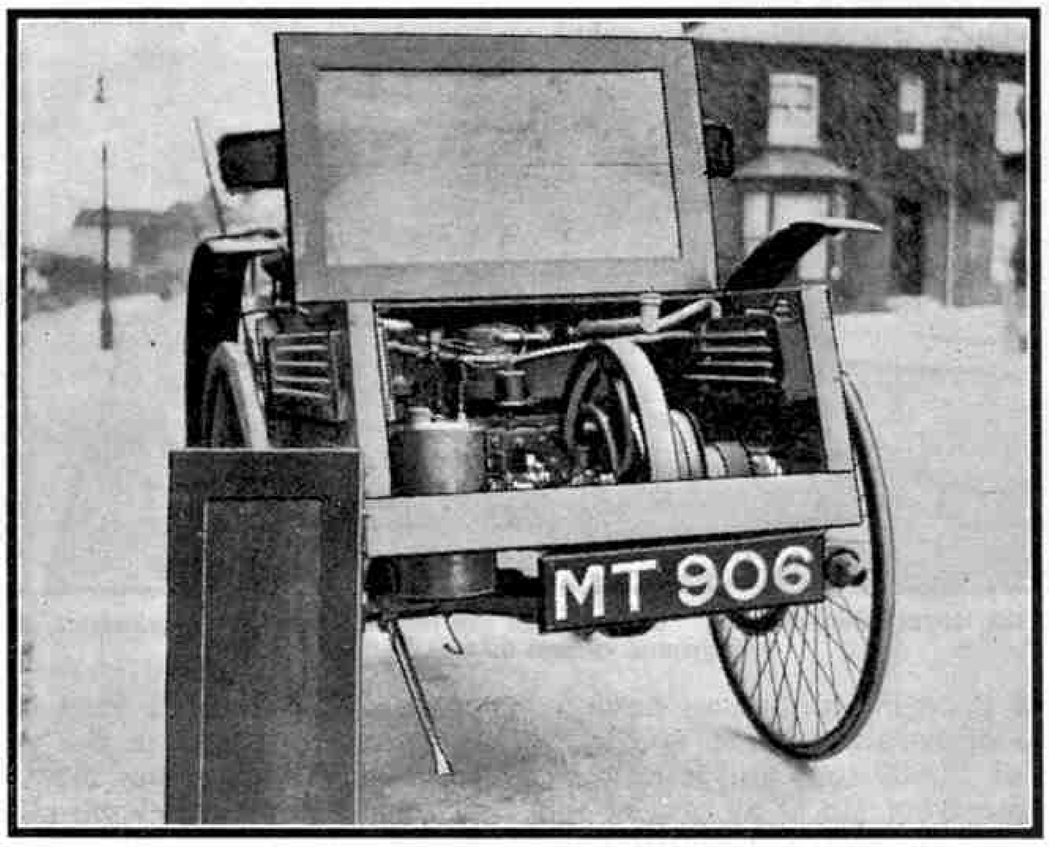
By E. de W. S. Colver

FOR a long time it had been my ambition to acquire a veteran car and to participate in the classic revivals of the historic London-Brighton run, and in June, 1931, this ambition was realised when I became the proud owner of "Adam," an "Arnold Motor Carriage" that had actually completed the original Emancipation Day run from London to Brighton in 1896. Although I expected that it would probably add a considerable proportion of trouble to the sport, I had been anxious to get one of the earliest motor-cars available, and "Adam" certainly attained this ideal.



The author and his dog enjoying a ride in "Adam." At the time this photograph was taken the renovation of the car had not been completed.

Various circumstances made it impossible for me to take possession of the car until the middle of July, but I had already entered it for the August Bank Holiday Race at Brooklands, and we arrived at the track for that event without having had a chance to do more in the way of preparation than ascertain that the engine would run—when one had managed to get it started! I cannot say that that race was one of "Adam's" triumphs. The original catalogue euphemistically states that "these cars will climb gradients of 1 in 10," but is silent as to whether the feat is accomplished by the car alone or with driver or passenger. "Adam" was quite definite that, whatever the gradient from the finishing straight to the home banking might be, vigorous assistance from both driver and passenger was essential, in addition to his own efforts, if he was to get to the top. The result was that we completed the first lap of the mountain course just after the rest of the field had finished.



Rear view showing the general arrangement of the engine and mechanism. The engine is started by pulling the large flywheel round by its rim.

In spite of this very "also ran" performance, the blandishments of Capt. J. H. Wylie, the indefatigable secretary of the Veteran Car Club, persuaded me to enter "Adam" for the London-Eastbourne Rally on 8th September, although the cold light of mature consideration next day made one think that the 56 miles specified on the route card would probably appear to have been multiplied by 1,000 if "Adam" were anything like as willing as he had been at Brooklands.

We had about five weeks in which to work miracles, and we tackled a complete overhaul that had not only to repair the ravages of rust and decay, but also to resurrect a number of original fittings for which some vandal had substituted modern parts. Time did not permit us to remove the modern carburetter, as several parts were missing from the old surface vaporiser and replacements could not be obtained in time. The cylinder barrel is a separate casting from the water jacket and assembly involves making a compression and watertight joint in a most awkward place, and this can only be tested by re-erecting the engine in the car and running it. Four times we made that joint, only to have it give out after about 10 minutes under load, so that eventually the car had to be taken to the starting point by lorry without even having had the final attempt tested. We arrived late at night, tanks empty, and decided to get up early the next morning and have a trial run before we were due to start at 9 a.m.

This programme started well, but crashed badly when we found that Croydon Aerodrome is definitely *not* the place at which petrol is obtainable in the early morning. It was 8 o'clock before we could get a supply, and then nothing would induce the engine to keep running. We feared that the cylinder joint had failed again, but there was no evidence of this, and eventually we diagnosed a choked jet. To dismantle the carburetter was an hour's job, but it had to be done, and then it was evident that our petrol had been handled through dirty cans.

We put the bits and pieces together again and were rewarded by a healthy revving engine. But it was

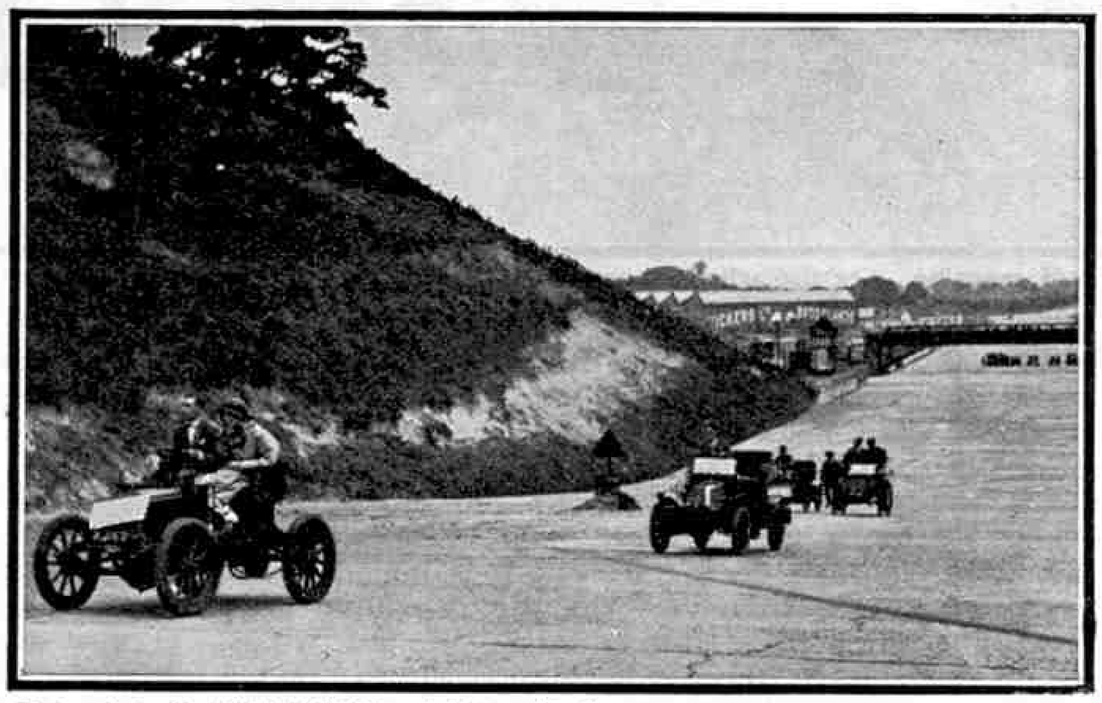
11.30, and we should have started at 9.0; all the other veterans had gone long ago, and so had the breakdown lorry that was to follow the procession. Incidentally, our spare battery and personal luggage were on the lorry. After some cogitation we decided to try to make Eastbourne—where we were due at 4.30 to qualify for a plaque and certificate—though, with the breakdown lorry *ahead* of us, it appeared to be an undertaking very similar to an attempt on the East to West Atlantic flight. A trial sprint round the concrete to the cheers of the aerodrome staff gave us confidence, and thinking on modern lines, an average of 11 m.p.h. did not seem to be too wild, so we drove out on to the great high road for the adventure.

We made quite a good speed for about quarter of a mile, but then the gradient of the road past the Aerodrome resulted in "Adam" resolutely refusing to ascend unaided, even on bottom gear, and we had to push. I should perhaps mention that "Adam" has only two gears, obtained by belt drive, being too early a model to be fitted with the luxury of a "Crypto" additional gear, such as is found on all the later Benz cars. The drop into Purley, however, cheered us up enormously, and hopes again began to rise. The gradient out of Purley was not a joy, and the further we went the worse things seemed to get. At the slightest suggestion of what the route card described as "up-grades" energetic help was instantly demanded by "Adam," and the engine stalled on countless occasions, so that very soon our hands were covered with blisters from frequent swinging of the flywheel to restart it. On through Caterham and Godstone it was the same story, and I became convinced that the jet must again be more or less choked, but my mechanic was firmly convinced that it could not be. I think he did not relish another hour stripping down that most inaccessible contraption, and as he was doing the major part of the pushing and collecting the most blisters from engine starting, we carried on. At last we got to East Grinstead, and there I was so thoroughly fed up with the performance that I sent the mechanic away to get water to replenish our tanks and while he was gone I made a start on the carburetter and it was half off when he returned, so settling any further argument as to investigating that component. The jet was half blocked. We ditched the rest of that petrol, flushed out and refilled, and at 4.30—the latest time for checking in at Eastbourne—we were ready to start again. So far we had made the magnificent average of slightly under 4 m.p.h.

Now it seemed as if we had obtained a magic wand, for "Adam" really began to behave as a horseless carriage should when showing these moderns that there is life in the old dog yet. Fearsome tales had been spread regarding the climb through Ashdown Forest, so we took the precaution to stop in Forest Row and shorten the low gear belt, and then off we went again. Probably the contrast with our earlier running was too much for us, for we kept wondering when we were going to reach the hill, and changed into top gear—whereupon the engine stalled! While we were restarting, a fairly large modern car passed and changed down, so we concluded we really were on the hill, and we climbed the rest of it with no trouble. Over the top, we began to move in great style, doing a good fifteen miles per hour along reasonably favourable stretches.

"Adam" shows his paces before an admiring crowd of spectators. Photograph by courtesy of "The Autocar."

We had a spot of excitement doing this speed along a good level road, when I noticed a string of cars travelling fairly fast towards us, and thought it would be advisable to slow down to allow them to pass. I may have braked rather too suddenly, for the spare tin of petrol at the mechanic's feet jumped off the floorboards and fell straight under the offside rear wheel. We developed a "speed wobble" that carried us from side to side of the road and which the short tiller appeared to be quite incapable of correcting for what seemed to be half a mile. Just before the approaching cars drew level we charged the near side curb and stopped, luckily with no more serious damage than a dent in a front rim and the silencer coming adrift from the exhaust pipe. After that we treated "Adam's" speed propensities with much greater respect!



Entrants in the 1931 "Old Crocks' Race" climbing the slope that caused "Adam" so much trouble. Photograph by courtesy of "The Motor."

We continued to make really good progress through Uckfield and East Hoathly, and got to Horsebridge as darkness came on. Here we stopped to pick up water again and to light the candles in our carriage lamps, and so on through Hailsham and Polegate, though it was not easy to find our way on strange roads with such magnificent illumination. At last we got to Willingdon, and the ascent of that hill in the dark is still rather remembered as a nightmare! It was extremely difficult to see what the road was like, so we had no chance to make use of any favourable easing of the gradient, or to "snake" up, and much pushing was required to gain the top. However, we did get up,

(Continued on page 470

World's Fastest Transport Machine

The Heinkel He.70 low wing monoplane is claimed to be the fastest transport aeroplane in the world, having a maximum speed of 225 m.p.h. when carrying four passengers and a crew of two. The story behind the production of the machine is interesting. On the order of the German Transport Minister, the Heinkel Company began in the summer of 1931 to prepare designs for a fast mail and passenger machine. The plans had just been completed and approved by the Minister when an American Lockheed "Orion" was put into service by an air transport company in Switzerland. This had a higher speed than the proposed German aeroplane, and consequently the German authorities gave instructions for the old designs to be scrapped and new ones to be prepared. In order to obtain the latest information on high-speed machines, two engineers were sent to the United States where they made an extensive study of the latest methods of construction. As a result, the He.70 has appeared.

The new machine is of the low wing cantilever type, with a wing span of 14.8 metres, or 48.55 ft., and an overall length of 11.3 metres, or 37 ft. The wings are made of wood, but the remainder of the machine is of all-metal construction, and great attention has been paid to efficient streamlining. A modern feature is the provision of an undercarriage that is retractable, or can be lifted up into the wing when the aeroplane is in flight. The raising and lowering of the landing gear is effected hydraulically, but a mechanical system also is provided for use in emergencies. In order to prevent accidents, a lamp is lit and a piercing electric horn sounded when the engine is throttled for landing if the wheels are not down in the correct position.

Another modern feature is that instead of water, a chemical known as Glycol is used to cool the engine. As this chemical boils at a temperature of 120°C. it is possible to employ a smaller radiator than would be necessary with water. The radiator protrudes under the fuselage and is retractable.

The machine has already set up a new international record, over the 100 km. closed circuit, for aeroplanes carrying a pay load of 500 k.g. The record made was about 216 m.p.h., far exceeding the previous one of about 186 m.p.h. made by a Lockheed "Vega." The landing speed is 68 m.p.h., but it is hoped in the future to reduce this by providing flaps along the trailing edges of the wings. The He.70 could fly from Berlin to London in three hours.

Including a wireless set, blind flying instruments and cabin furniture, the weight of the machine is 5,190 lb. With a crew of two, fuel for three hours, four passengers and luggage or mail, the all-up weight is 7,414 lb. When loaded to this limit the machine will rise to 1,000 metres in 3.4 min., and to 5 000 metres in 25.4 min. The service ceiling is 5,700 metres.

Passengers entering a K.L.M. machine. See also article on page 434. For permission to reproduce this photograph and the illustrations on the opposite page we are indebted to Royal Dutch Air Lines.

A Cheap Light Aeroplane

A two-seater light aeroplane to sell at about £395 has been designed by Mr. F. G. Miles of Phillips & Powis Aircraft (Reading) Ltd. The machine is a full cantilever low wing monoplane and is extremely simple and sturdy in design. Full performance details are not yet available, but the machine lands at about 45 m.p.h., and is expected to cruise at more than 90 m.p.h. and to have a maximum of 110 m.p.h. The estimated endurance is four hours, and the petrol consumption approximately one gallon for 23 miles. Actually the "Hawk" will cost more than the £395 stated when a number of "Cirrus" engines in stock have been used up. The engines are new, but were available at a low price when a Canadian firm stopped production.

The wings of the aeroplane are arranged so that they may easily be folded by one man for garaging purposes. The machine therefore should be particularly suitable for the private owner, and we hope shortly to publish an illustrated description of it.

New Short Landplane

Short Bros. (Rochester & Bedford) Ltd., the constructors of the famous Short range of flying boats, are to build two landplanes for Imperial Airways. The new machines will be similar in constructional details to the "Scipio" illustrated on page 367 of our issue for May, 1931, under the name of Short "Kent," but they will of course be fitted with fuselages instead of the boat hulls.

The new machines will each be able to accommodate 38 passengers and a crew of four, and will be equipped with Bristol "Jupiter XFBM" engines arranged in line abreast as in the "Scipio" flying boat. The passengers carried will be more than double those that can be accommodated in the flying boat type, in which there is only room for 16. The new machines will each have a gross weight of about 32,000 lb. and are expected to be ready for service by about November or December of this year. Photographs and full details will be published in due course.

Hydraulic Brake for Aeroplanes

A hydraulic brake that utilises the metal disc clutch principle, and is designed especially for aeroplanes, has been developed by the Goodyear Tyre & Rubber Co., of Akron, Ohio. The brake is intended for use with the Goodyear "Air-wheel," or low pressure balloon tyre. Hydraulic brakes have been used previously on machines fitted with these and other tyres, but they have been merely adaptations of motor car brakes and consequently have had limitations in aeroplane use. It is claimed by the Goodyear engineers that in the average mechanically-operated or cable - controlled braking apparatus only about 35 per cent. of the power applied is delivered to the brake mechanism itself, whereas in the new hydraulic brake the efficiency rating is 97 per cent.

The hydraulic brake is simple in construction, consisting of a series of bronze discs keyed to engage and rotate with the wheel, and a set of alternating steel discs keyed on the brake itself, that do not rotate. Oil pressure is applied through a master operating cylinder by means of the brake pedal, and it moves through an oil line and down to the brake itself, where another piston is made to move and to press the rotating discs against the non-rotating discs, thus creating controlled friction and braking action.

The unit is housed in the inside flange of the wheel, and consequently the heat developed in braking cannot harm the tyre or inner tube. The brake has 350 sq. in. of braking area and operates at an oil line pressure of approximately 150 lb. In a band-type brake of similar size the braking area is only 72 sq. in., and the pressure required is 600 lb., or 450 lb. more than the new type.

The Goodyear brakes can be installed on aeroplanes originally equipped with mechanical brakes or band-type hydraulic brakes, and they possess the advantage that on new machines it is unnecessary for the manufacturer to design extra support for the transmitting of power by means of bell cranks, pulleys and cables.

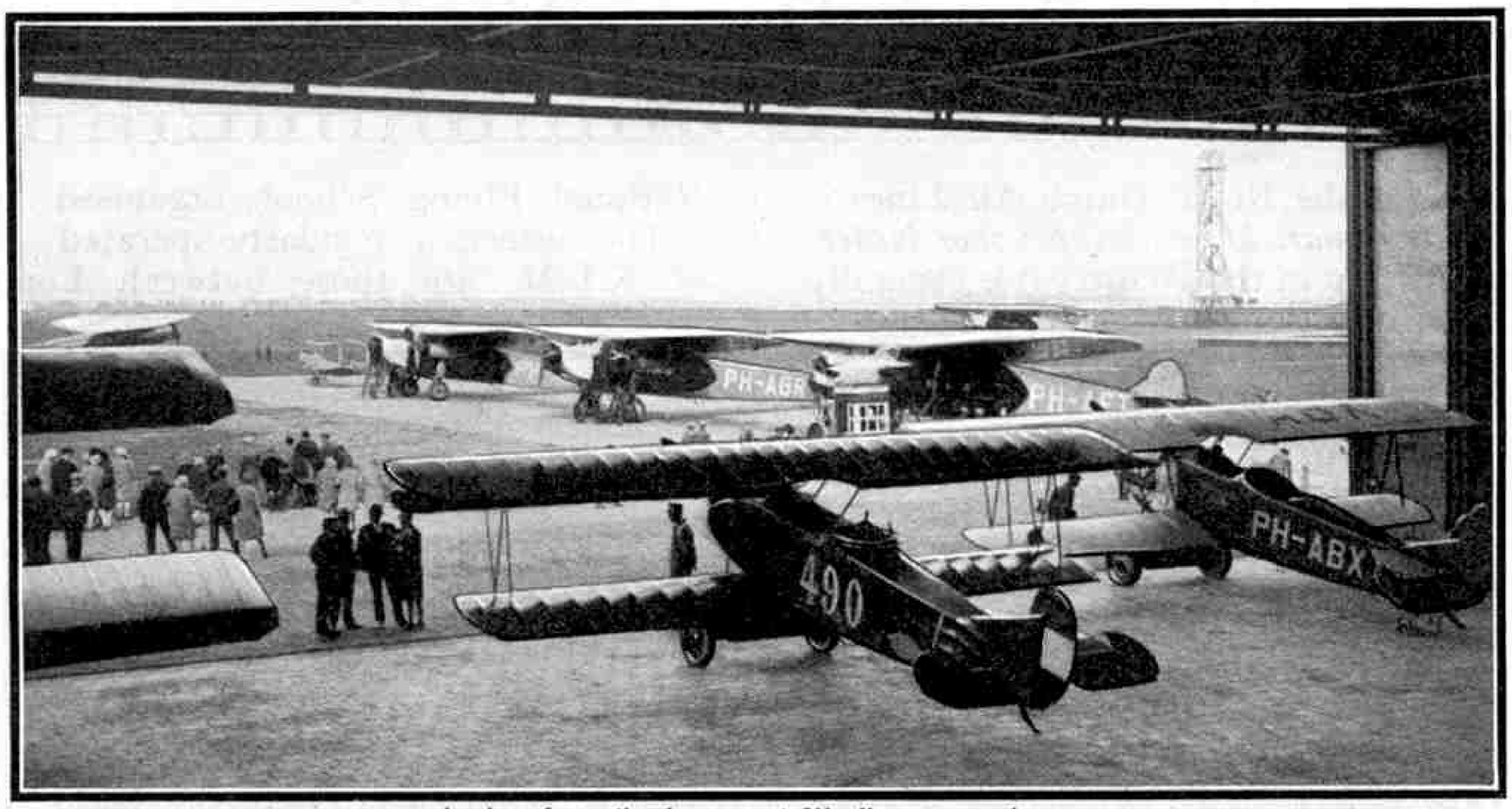
Gliding for 74 Miles

A German airman has made a flight of 74 miles in a glider. He flew from Griesheim, near Darmstadt, to Mimbach, in three hours.

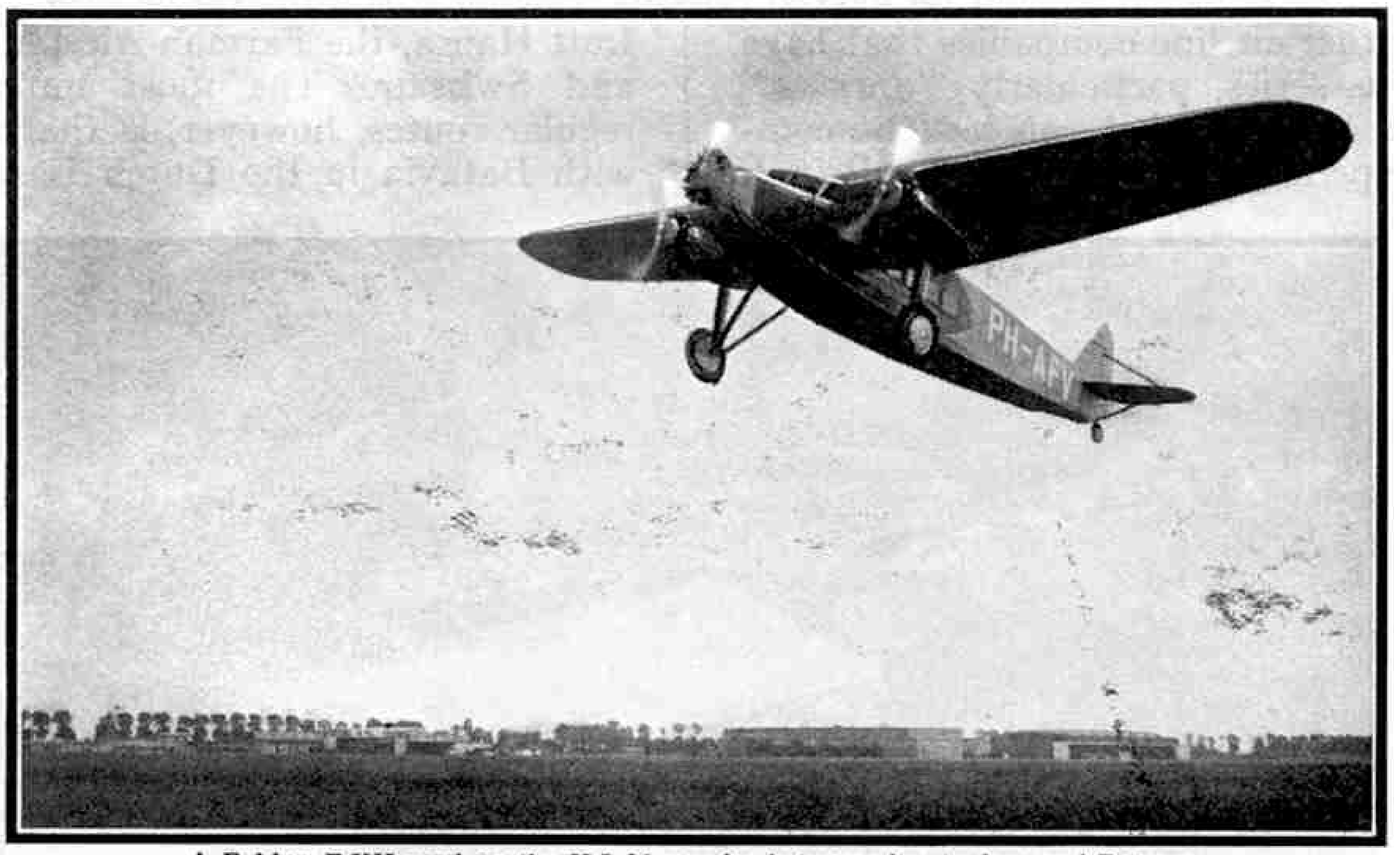
Radio on the African Service

Interesting details are now available concerning the work that has been in progress in developing short-wave signalling on the African airway. The territory traversed by this route is subject to electrical storms, many of which affect areas of 1,000 sq. miles at the same time. Conditions therefore are often unfavourable for long or medium wave radio transmissions, but good results are obtained with the specially designed short-wave apparatus employed on the aeroplanes flying over the route. The apparatus used provides telephonic and telegraphic transmission between aircraft and ground stations on a short-wave band of from 40 to 80 metres.

During test transmissions between air liners and ground stations some remarkable results have been obtained. On one occasion, while an aeroplane was flying over the White Nile between Juba and Kampala, it established contact with the British Post Office station at Portishead, near Bristol, about 4,000 miles away. On a flight in another neighbourhood news items were picked up and written down correctly from a station that was broadcasting at Miami in Florida. Several long-distance contacts were established also with stations in Germany and Italy.



A view from the hangar at Waalhaven aerodrome.



A Fokker F.XII used on the K.L.M. service between Amsterdam and Batavia.

American All-Night Aerodrome

One of the most interesting American aerodromes equipped for all-night flying is the Allegheny County Airport, Pittsburgh, which has been fitted out with lighting and control apparatus by the Westinghouse Electric and Manufacturing Co. The aerodrome is a very busy one, and a particularly noteworthy feature of the installation is the method by which traffic is controlled. It is handled from a control tower at the top of the Administration Building, and all lighting equipment on the field is directed by the despatcher in this room. This man sits at a control desk on which is marked out a complete outline of the field, with small lamps representing beams, markers and signal lamps; and a compass and wind indicator also aid the operator. The direction in which the wind is blowing is indicated to pilots about to land by rows of lights along each side of the runway, which are automatically switched on.

Fighting Locust Plagues by Air

Experts at the War Office Chemical Department on Salisbury Plain are studying methods by which locust swarms may be exterminated from the air while on the wing, and in connection with the experiments it was necessary to obtain as quickly as possible a considerable number of live locusts. To meet this demand the Governor of Kenya shipped several crates of insects to London by Imperial Airways, and only seven days after having been put on board a machine at Nairobi the locusts were unloaded at the London Airport and were sent immediately to the Research Laboratories on Salisbury Plain. Here it was found that although some had died on the journey, there were sufficient left alive to provide for a number of important tests, during which the insects were placed in wind tunnels and subjected to a spraying treatment with creosote and also with sodium arsenite dust.

The object of these experiments is to discover improved methods of dealing with the locust plagues in Africa, and in particular to work out a scheme by which aeroplanes can attack locusts when they are on the wing and destroy them by releasing chemical clouds. It is estimated that during the past few years the damage done by locusts in Africa has amounted to more than £6,000,000. The work is therefore supported by the African authorities.

Famous Air Line Companies

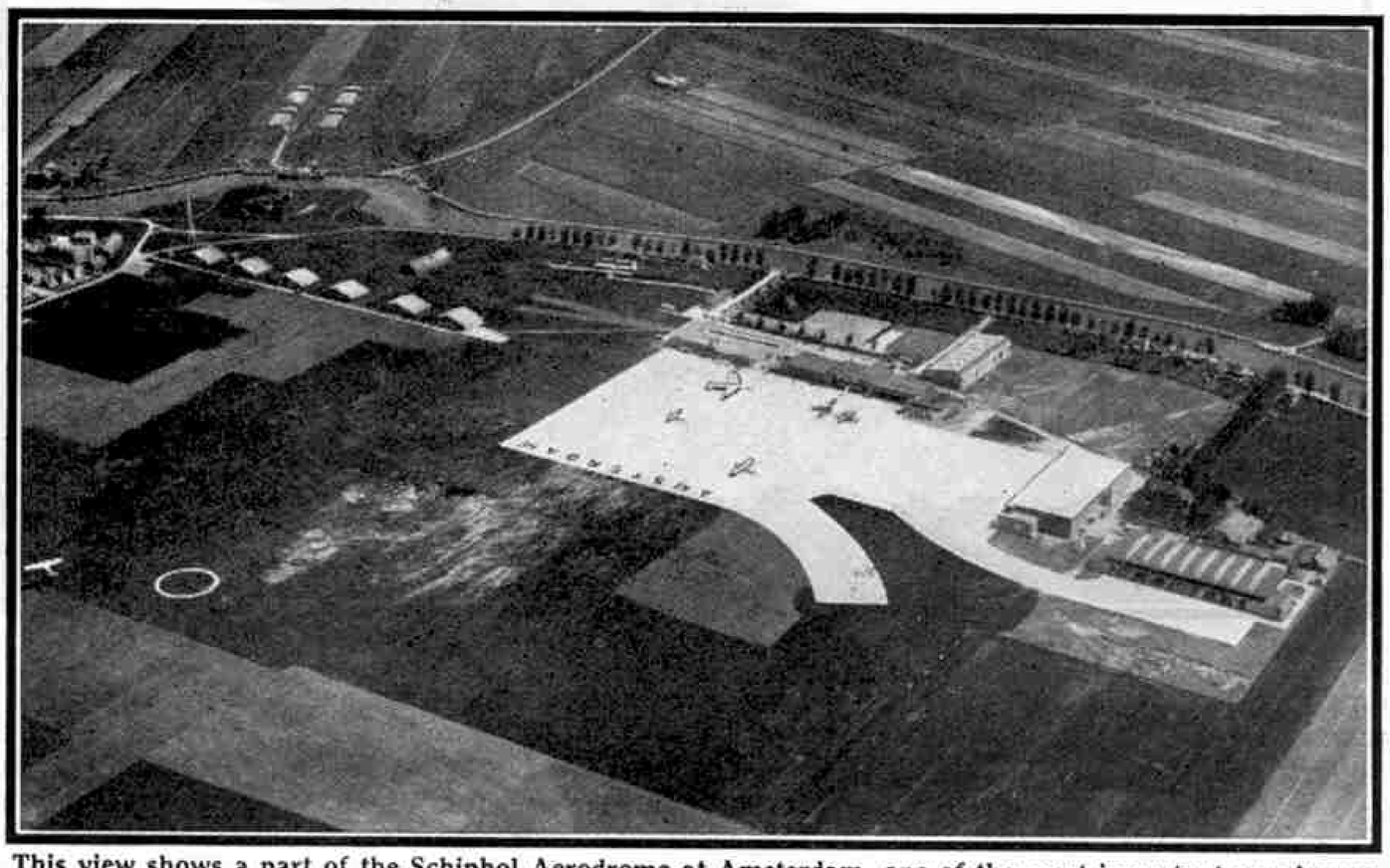
V.—Royal Dutch Air Lines

THE correct name for the Royal Dutch Air Lines is "*Koninklijke Luchtvaart Maatschappij voor Nederland en Kolonien*," but in this country it is generally referred to by either the British name or "K.L.M.," the latter being the more popular. The company have been in operation for some years now, and are one of the most successful and progressive air line concerns in the world. The nature of the work carried out by the company is rather different from that undertaken by some of the other air line companies that have been dealt with in this series, particularly "*Qantas*" and Canadian Airways Ltd.; and it can best be compared with that of Imperial Airways Ltd., the British air operating company. The main difference is that far more actual air line work and less special charter work is done by the Dutch company, the reason being of course that Europe is much more densely populated than Australia or Canada.

Passengers proceeding to the Customs after deplaning at Amsterdam from a K.L.M. machine that has travelled from London. The photographs illustrating this article are reproduced by courtesy of the Royal Dutch Air Lines.

The two central airports of K.L.M. are the Schiphol Aerodrome at Amsterdam and the Waalhaven Aerodrome at Rotterdam. The latter port, opened in 1920, has become one of the most important and best equipped aerodromes in Europe. It is used by German, French and Belgian air companies, as well as the K.L.M., and from it more than 30 important towns and cities in western and middle Europe can be reached in one day. The Waalhaven Airport is the centre of the K.L.M. technical and photographic departments and of the National Flying School, organised by the company.

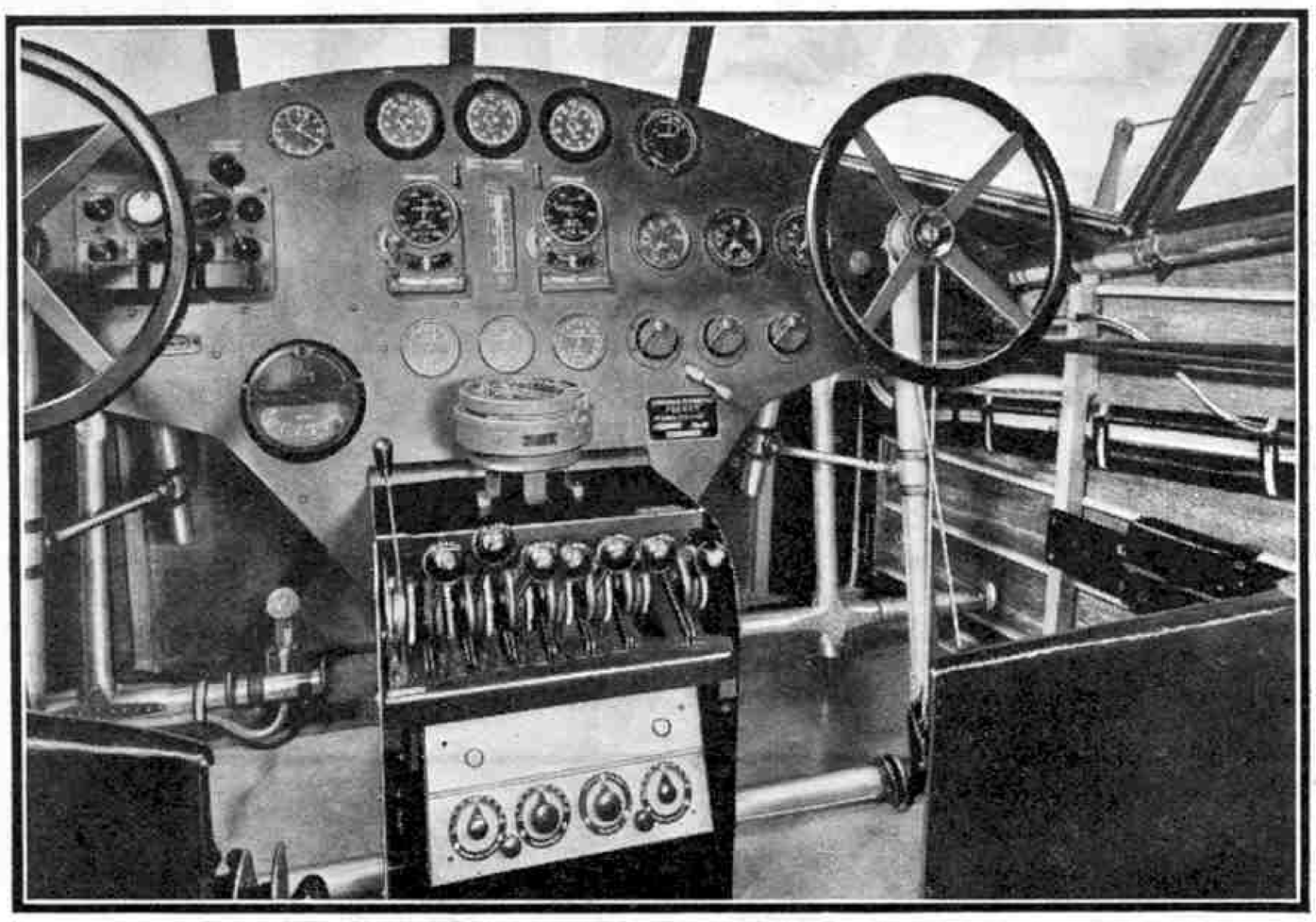
The principal regularly-operated European services of K.L.M. are those between London, Amsterdam, Rotterdam, Hamburg, Copenhagen, Malmo, Hanover and Berlin; and the "*Scandinavian Air Express*" from Paris to Malmo. These services are operated daily in both directions by K.L.M., and services are operated also from the Schiphol Aerodrome by other companies, such as the Deutsche Luft Hansa, the Farman Air Lines, A.B. Aerotransport, and Swissair. The most important of the K.L.M. regular routes, however, is that connecting Amsterdam with Batavia in the Dutch East Indies.



This view shows a part of the Schiphol Aerodrome at Amsterdam, one of the most important aerodromes in Europe.

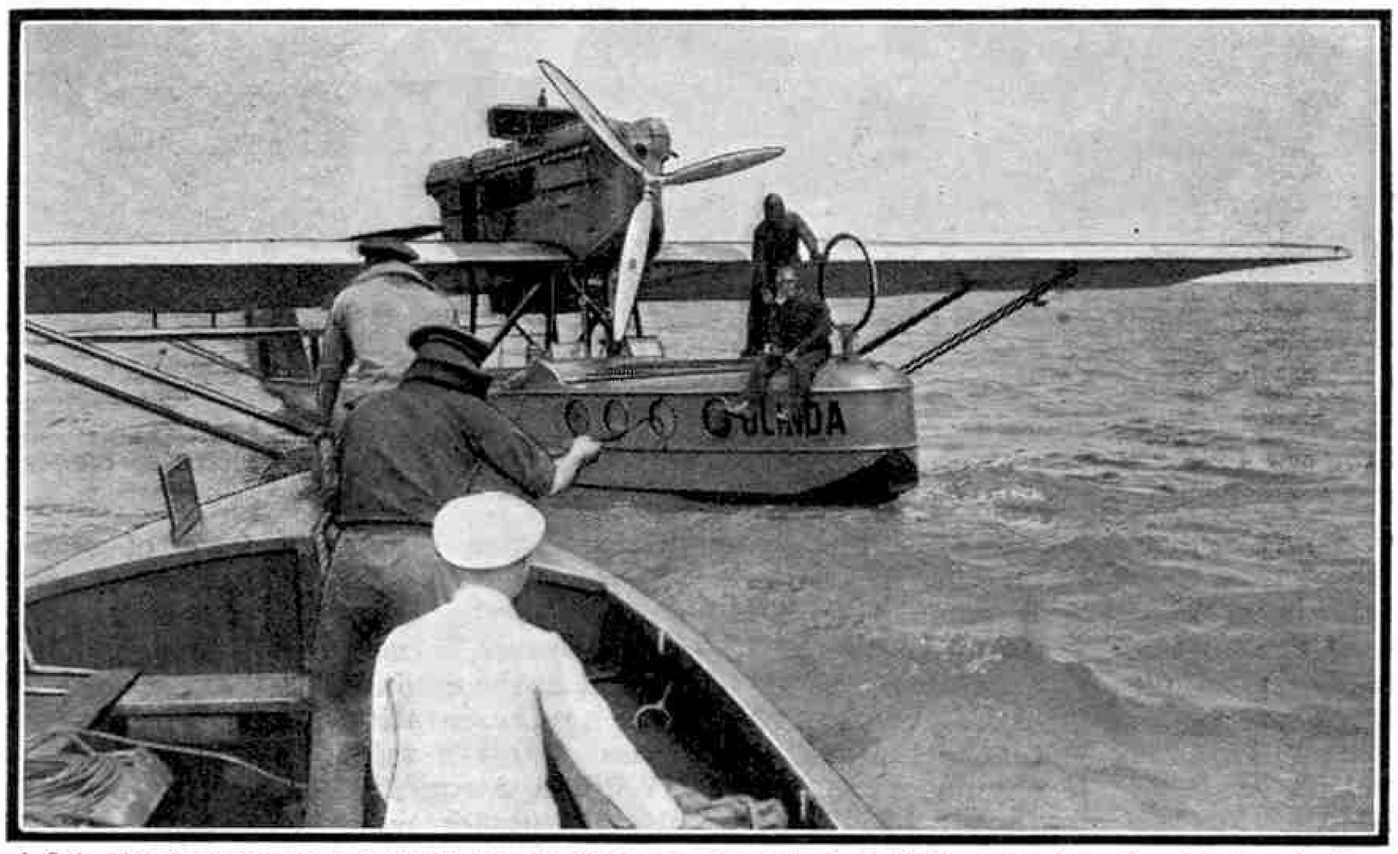
It is in the operation of the Amsterdam-Batavia service that the difference in the policies of Imperial Airways and the Royal Dutch Air Lines is revealed. In operating the Empire air services different types of machines, both landplanes and flying boats, have been developed for service over certain sectors of the route. For instance, on the London - Capetown journey, passengers are carried in Handley-Page "Hannibal" machines to Paris, then in Short "Scipio" flying boats across the Mediterranean, and finally in Armstrong Whitworth "Atalantas" from Cairo to Capetown. The last-named are four-engined high wing monoplanes designed by the Sir W. G. Armstrong Whitworth Aircraft Co. Ltd. for Imperial Airways, and specially for this sector. K.L.M., on the other hand, prefer to work on

the same principle as shipping companies, and the same machine is used to complete the whole of one journey. This arrangement has many advantages, the greatest probably being that far fewer machines are required, so that a weekly service can be regularly operated with only six aeroplanes. Naturally the same crew remains with each aeroplane, and so the expense of stationing personnel at different points along the line is not incurred. A further similarity between the K.L.M. Amsterdam-Batavia service and a shipping service is that the company have no ground organisation except at the termini, making use of various other airports as a ship puts in at a seaport.



The cockpit of a Fokker F.XII machine used on the K.L.M. Amsterdam-Batavia service.

It is practically certain that many additional services will be inaugurated by K.L.M. in the future. For instance, the company are stated to be acting in conjunction with Iona International Airways Ltd., of Dublin, who are endeavouring to obtain permission to start an air service between Galway, London and the Continent. As mentioned on page 343 of our last month's issue, the service would be used to carry passengers, mails and luggage landed from Atlantic liners at Galway to their destinations in much less time than if they remained on the ship and completed the journey by way of Southampton. The company have also offered to convey the air mails from Europe to Australia, without any subsidy. It is probable that this offer will be rejected, however, and that an Australian air line company, and the present British service from London to Karachi will be extended. Permission was obtained by K.L.M. in 1932 to pick up at Rangoon Indian mails for Europe, and to carry them to Calcutta to be delivered to the postal authorities for onward transmission.



A flying boat owned by the Royal Dutch Air Lines, awaiting the arrival of a motor launch on the termination of a successful flight.

As the service between Amsterdam and Batavia is by far the most important and interesting of those operated by K.L.M. we will describe this route in some detail. The European services of K.L.M. are very similar to those operated by Imperial Airways and the other big air line companies, and indeed are carried out so regularly and efficiently that there is little to be said about them.

The first experimental flight between Amsterdam and Batavia was made in October, 1924, by a K.L.M. pilot in a Fokker F.VII machine equipped with one Rolls-Royce "Eagle" engine. The flight was carried out successfully, and it demonstrated convincingly that a regular service between the two places was possible. It was followed by a return flight in a Fokker F.VII fitted with a Bristol "Jupiter" engine, 13 days being taken to reach Batavia and 14 days to return. Subsequently the outward journey was made in 9 days and the return in 10 in a Fokker F.VII 3-m equipped with three Armstrong-Siddeley "Lynx" engines.

It is interesting to note the part that has been played by Fokker machines in developing this route, for Fokker aircraft are still solely employed on it. Only triple-engined aircraft are used and, as previously stated, the method of operation makes it possible for six aeroplanes to work the service efficiently. It may surprise some readers to learn that these landplanes are flown across considerable stretches of sea, as for instance across the Mediterranean from Athens to Merza-Matruh; but with the margin of safety provided by the use of multi-engined machines it is very unlikely that any trouble will be experienced in such crossings.

Since the inauguration of the service there have been many changes in route. In summer, after leaving Amsterdam the machines fly across Europe by way of Halle-Leipzig, Budapest and Belgrade, and then on to Athens, from where they cross the Mediterranean to Merza-Matruh and Cairo. From Cairo the crossing of Arabia is made to Baghdad, first passing over Gaza. During the winter, after starting from Amsterdam the aeroplanes fly straight to Marseilles and then on to Rome, Brindisi, Athens and Beirut to Baghdad. After Baghdad the same route is followed in both summer and winter, the next places of call being Bushire, Jask and Karachi. The crossing of India is made more or less along the valleys of the Indus and the Ganges by Jodhpur, Allahabad and

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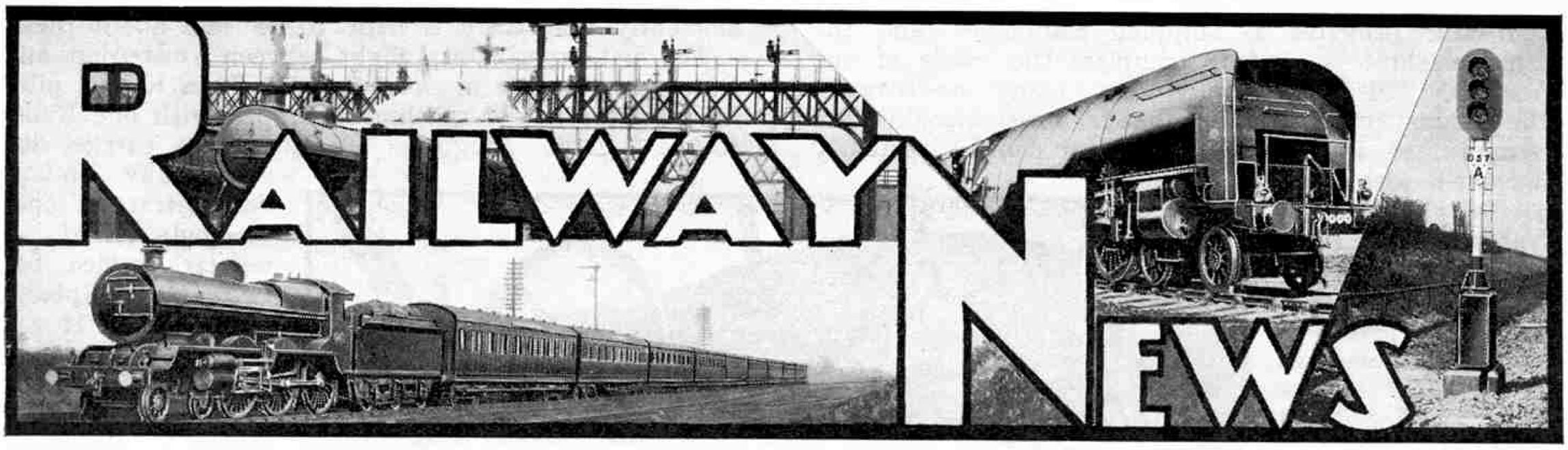
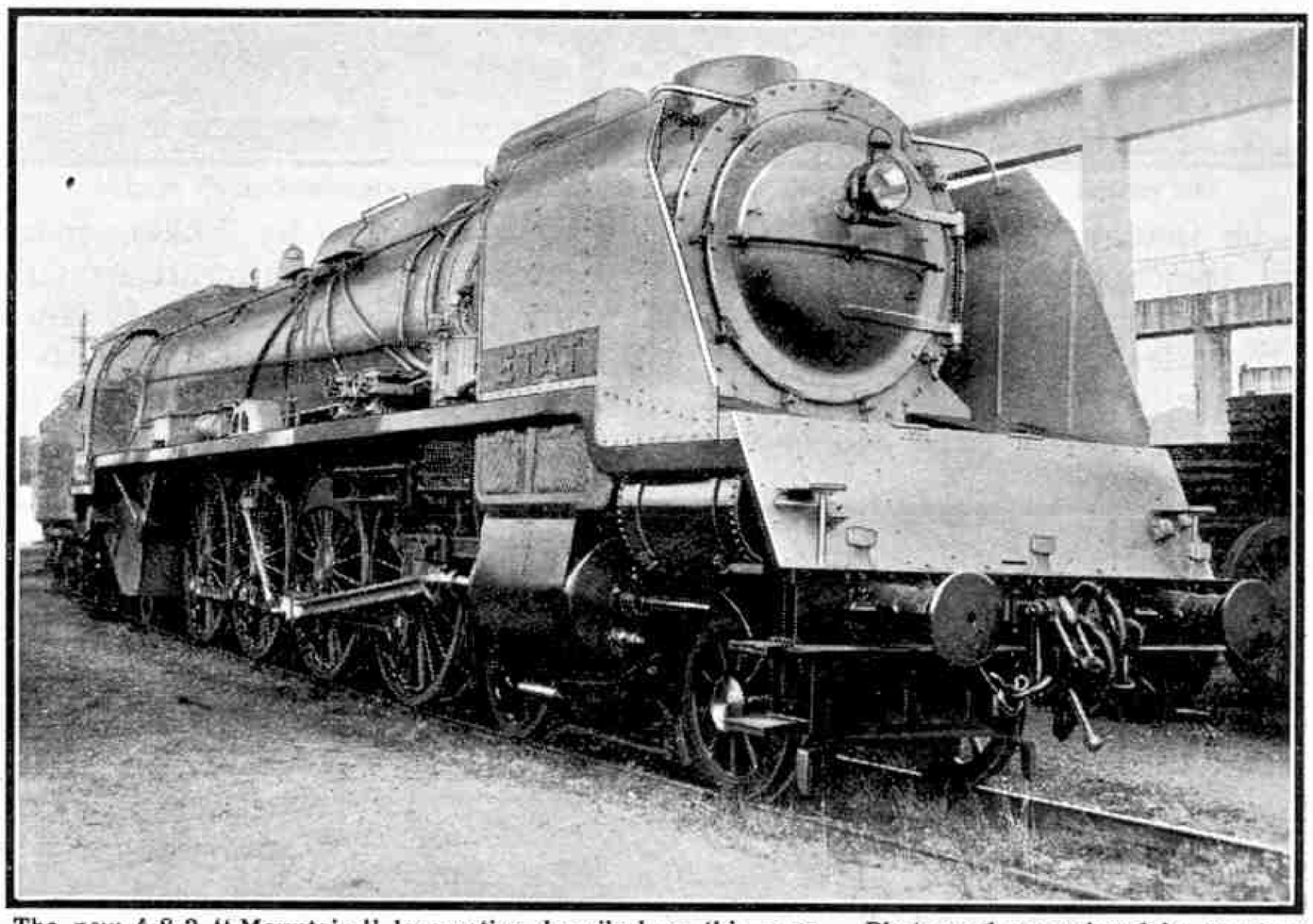


"Mountain" Locomotives for French State Railways

Locomotives of the 4–8–2 or "Mountain" type are being favoured increasingly for express work on the railways of France, and a new massive engine of this class has just been built for the French State Railways and is now being tried out in service. In several important features it marks a new departure in French practice. It is the first simple express locomotive in France to have three cylinders, the two outside ones being 20¾ in. in diameter with 30 in. stroke, while the inside cylinder is 22½ in. in diameter but has a stroke of only 25½ in. The coupled wheels have a diameter of 6 ft. 4¾ in., the inside cylinder driving the leading axle and the outside cylinders the second. Steam distribution in the cylinders is effected by means of Renaud poppet valve gear which is operated for all three cylinders from one side of the locomotive only. The boiler has a total heating surface of 3,787 sq. ft. and a grate area of 54 sq. ft. The working pressure is 290 lb. per sq. in. An innovation for France is the fitting of a mechanical stoker.



The new 4-8-2 "Mountain" locomotive described on this page. Photograph reproduced by courtesy of the French State Railways.

The total weight of the engine in working order is 122 tons, of which 77 are on the coupled wheels. The tender runs on roller bearings, has a water capacity of 8,000 gallons, and carries over 11 tons of coal. When full it weighs 77 tons, thus making a total of 199 tons for the combined engine and tender.

The external appearance of the new locomotive is very striking, as the chimney, dome, cab and other parts have been shaped to cut the wind and lessen resistance.

The capacity of the new engine is well shown in that on one test run it took a train of 620 tons from Havre to Rouen—a distance of 54¾ miles, with some heavy gradients—in 53 min. In regular work it will be employed on the boat trains between Paris and Cherbourg, and on other fast and heavy services on the State Railways. The new schedule for the 230½ miles non-stop run between Paris and Cherbourg is to be about 4 hours—a cut of half-an-hour. Until two years ago, the best time was 5 hours.

S.R. Locomotive News

Of the new 4–4–0 express locomotives of the "Schools" class, No. 910, "*Merchant Taylors*," No. 911, "*Dover*," and No. 912, "*Downside*," are stationed at Ramsgate; and No. 913, "*Christ's Hospital*," and No. 914, "*Eastbourne*," are at Eastbourne. Five of the fine 4–6–4 "Baltic" tanks, now freed by the electrification of the Brighton line from their former duties on that route, are also now shedded at Eastbourne. Among them is the War-memorial engine "*Remembrance*," now renumbered 2333. Included in the engines at Eastbourne is No. 2160, a representative of the famous "D" class of 0–4–2 tank engines built by Mr. William Stroudley. In all 125 of these useful engines were built, but very few now remain in service and these mostly on "push and pull" motor trains. Although 4–6–0 engines of the "King Arthur" class take a share in working London-Eastbourne expresses, none of them is stationed at Eastbourne.

The Fastest Train in the World

Since 15th May the "*Flying Hamburger*," a Diesel-electric twin railcar, on the German Railways, has claimed the honour of being the fastest train in the world because it is timed to run daily from Berlin to Hamburg, 178.1 miles in 138 min., an average of 77.4 m.p.h., and to return in 140 min. at an average of 76.3 m.p.h. The fastest steam-driven express is still the G.W.R. "*Cheltenham Flyer*."

"Pacific" Locomotives for the L.M.S.R.

Probably the most interesting event on the British railways this year will be the advent of the new 4–6–2 "Pacific" express passenger locomotives that are now building at Crewe to the designs of Mr. W. A. Stanier for service on the L.M.S.R. Three are on order and the first is in such an advanced stage of construction that it is expected to be ready for trials in July. They will be the biggest express locomotives in Great Britain and their boiler dimensions, in maximum diameter, length and grate area, will exceed those of the Gresley "Pacifics" on the L.N.E.R. The boilers will be tapered and domeless, with a working pressure of 250 lb. per sq. in. The coupled wheels will be 6 ft. 6 in. in diameter and there will be four cylinders, each having a diameter of 16½ in. and a stroke of 28 in. The cylinder arrangement will be similar to that of the four-cylinder engines of the G.W.R. except that each cylinder will have its own independent valve gear. These "Pacifics" will have the new enlarged type of standard tender, holding 4,000 gallons of water and 9 tons of coal, one of which, equipped with "Timken" roller bearings, was fitted to engine No. 6100 "*Royal Scot*" for its visit to America. The new locomotives will have a massive and handsome appearance.

Further 4–6–0 express engines of the "Baby Scot" class have been completed at Crewe. They have taken the places of former engines of the "Claughton" class, whose numbers and names they bear, as follows:—No. 5907, "*Sir Frederick Harrison*"; No. 5926, "*Sir Herbert Walker, K.C.B.*"; No. 6011, "*Illustrious*"; No. 6018, "*Private W. Wood, V.C.*"; No. 6022; and No. 6027. New batches of "Baby Scots" and 2–6–0 "Moguls" that are to be built shortly will have taper, domeless boilers. The new 0–4–0 shunting saddle-tank engines are stationed as follows:—Nos. 1541 and 1542 at Edge Hill, Liverpool; Nos. 1540 and 1544 at Gloucester; and No. 1543 at Dawsholm, Glasgow. An illustration of locomotive No. 1540 appeared on page 202 of our March issue.

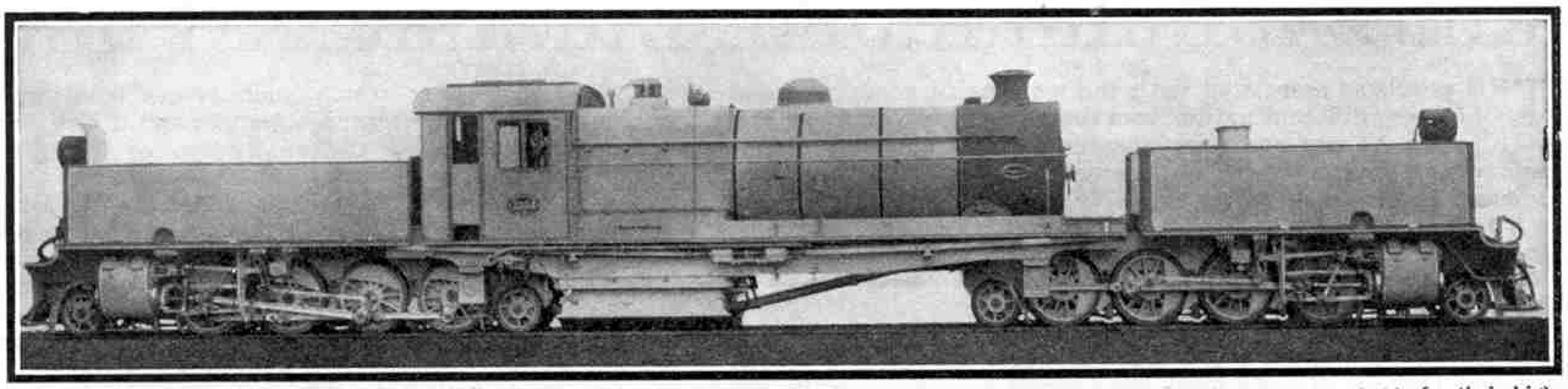
Some Fine Locomotive Performances

When last year the very fast, accelerated schedules came into force on the British railways, some doubts were expressed as to the ability of the locomotives to maintain them regularly in all weathers and with the checks that would inevitably occur from time to time. Experience has shown, however, that even the fastest of the trains are now keeping better time than they did formerly with the easier timings. On the L.N.E.R. the up breakfast car train from Leeds to London, with its exacting booking of 100 min. for the 105.5 miles from Grantham to King's Cross, often improves upon its schedule and arrives before time. A speed of 90 m.p.h. is frequently attained on favourable grades by the splendid "Pacifics" that work the train and a maximum of 93.7 m.p.h. has been registered.

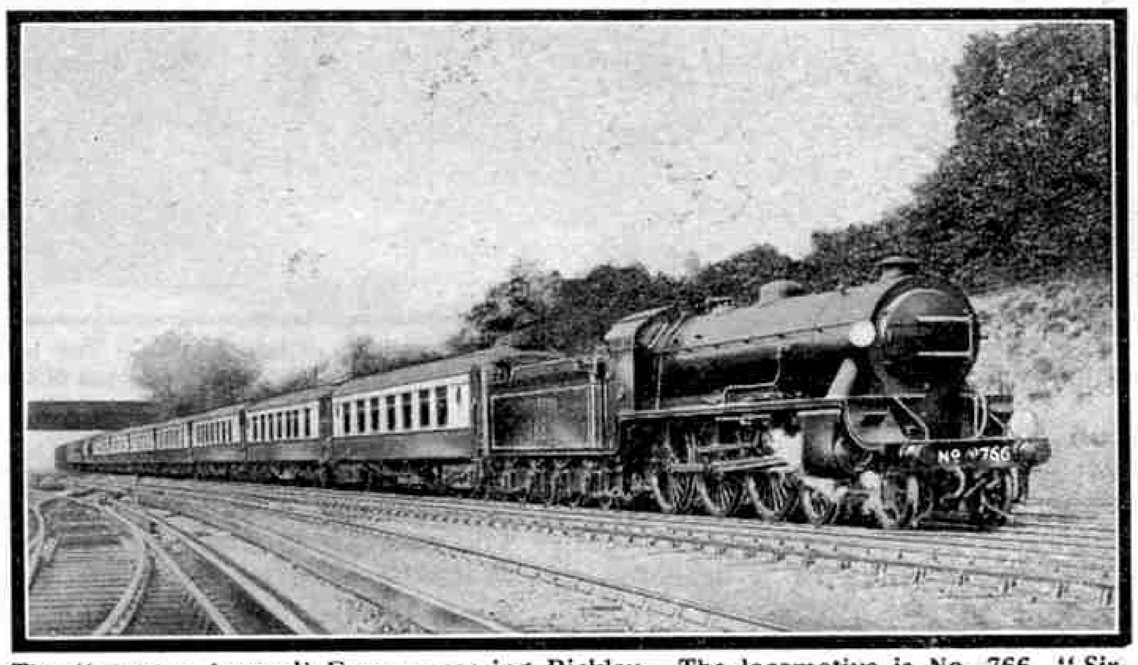
Several correspondents have forwarded logs of brilliant runs made on other lines and particularly of fast times achieved on the accelerated services of the L.M.S.R. between Euston and Manchester. Mr. Cecil J. Allen informs us that he was travelling one day recently by the up *"Lancastrian"* when a special stop had to be made at Nuneaton by which several minutes were lost. But on restarting, the driver at once set out to recoup the arrears and the 97.1 miles from Nuneaton to Euston were covered in 93 min. 20 sec., start to stop. For the 82.6 miles from passing Rugby to the final stop, barely 75 min. were taken. The engine was a Longsight "Baby Scot" No. 5959 and the train consisted of fourteen 8-wheel coaches and one six-wheeler, weighing, with passengers and luggage, 445 tons. On another day the up *"Mancunian,"* drawn by the same engine but in charge of Driver Earl, of Camden, was stopped at Polesworth because of injector trouble. Yet Euston was reached on time, the 106.5 miles from Polesworth having been done in 92 min., at an average speed of 69 m.p.h., with a load of 355 tons behind the tender. For the 13¼ miles from Roade to Bletchley the average was 89 m.p.h.

Another exceptional run was made by Driver Earl with engine No. 6114, *"Coldstream Guardsman,"* during Easter week. The train was the down *"Lancastrian"* due to leave Euston at 5.55 p.m. Owing to heavy traffic, extra coaches had to be added and the departure was delayed by 5 min. Crewe was passed 3 min. early, however, the 158.1 miles having taken but 152 min. Another correspondent tells of a run he had by the up *"Comet"* —5.40 p.m. from Manchester—on Easter Saturday when, although a start was made 5 min. late, the arrival at Euston was 7 min. early. The 133.6 miles from Stafford were done in exactly 2 hr., start to stop, showing an average speed of 66.8 m.p.h. The overall time from Manchester to London was 3 hr. 3 min., inclusive of the 2 min. stop at Stafford. The engine in this instance was No. 6167, *"The Hertfordshire Regiment,"* driven by Miller, of Longsight, and the train consisted of 8 coaches weighing (full) 240 tons.

From another reader details have come of a fine run he made at the end of April on the G.W.R. *"Cheltenham Flyer,"* loaded to six coaches (205 tons, full), drawn by engine No. 4082, *"Windsor Castle,"* with Driver Jones, of Old Oak Common, in charge. The 77.3 miles from Swindon to Paddington were accomplished in just 60 min.—to the very second! 80 m.p.h. was attained by Shrivenham (5.7 miles from Swindon), and between Steventon and Didcot an average of fully 90 m.p.h. was sustained. At Acton the speed was 88 m.p.h. The weather was drizzly and a signal check at Old Oak cost ¾ min.



One of a powerful class of 2-8-2 : 2-8-2 "Beyer-Garratt" locomotives of the South African Railways. These engines are remarkable for their high power in proportion to their low axle load, and were the first "Garratt" locomotives to incorporate the 2-8-2 or "Mikado" wheel formation.



The "Golden Arrow" Express passing Bickley. The locomotive is No. 766, "Sir Geraint" of the "King Arthur" class. Railway Photographs, Liverpool.

Another exceptional run was made by Driver Jones with the *"Flyer"* when special Easter traffic brought the load up to 10 coaches (335 tons). Even with so heavy a train the start to stop time was only 63 min.

Yet another correspondent, who has been travelling on the electric trains on the S.R. between London and Brighton, describes the running very favourably and records early arrivals in spite of checks en route.

Altogether it is evident that much meritorious running is being done on British railways.

Cruising by Train

A novel method of travel—that of "Cruising by Train"—is about to be introduced by the L.N.E.R. For the week from 17th to 23rd June, a special cruising train will travel through 2,000 miles of the finest scenery in England and Scotland. The train will consist entirely of first-class carriages equipped for both day and night travel. Each passenger will be allotted a numbered and reserved seat in the restaurant cars and an exclusive bedroom in the sleeping cars. A smoking room, writing room, ladies' room, shower baths, hairdressing saloon and special accommodation for luggage will all be provided on the train, the total weight of which will exceed 500 tons. Motor and steamer trips are also included in the tour. Much of the travelling in the train will be done by night, thus leaving the days free for sightseeing. Starting from London (King's Cross) the train will travel first to Edinburgh; from there it will proceed to Aberdeen from which point the Moray Firth coast, including Lossiemouth, will be visited. Later the "cruise" will include the Western Highlands, Loch Lomond, Glasgow, the Scott Country, Hexham, the English Lakes and the Yorkshire Coast. The return to London will be made via York, Lincoln, Ely and Cambridge. The inclusive charge for the "cruise," which is limited to 60 persons, is £20 each. This attractive experiment in travel will be followed with great interest.

Canadian Railways' 3,000 Locomotives

The number of locomotives in service on the Canadian National Railways is 3,000. This is 400 fewer than in 1923, modern railway practice being to reduce the number of locomotives by the introduction of more powerful types capable of handling longer trains and heavier loads. So rapid are the advances in the improvement of engine design that few locomotives "die of old age." Long before they are worn out, they are scrapped in favour of new and still more economical models.

L.N.E.R. 4-4-0 Engines Rebuilt

Another 4–6–0 engine of the "Sandringham" class, No. 2840, *"Somerleyton Hall,"* has been turned out from Darlington works. Two more 4–4–0 engines of the G.E.R. "Claud Hamilton" class have been rebuilt with round-topped boilers of the J39 class. They are Nos. 8854 and 8866. In rebuilding, many alterations have been made and the long familiar G.E.R. features have given place to the standard L.N.E.R. patterns in accordance with the designs of Mr. Gresley. In particular, the framing and splashers have been reconstructed and made similar to those of the 8571 series of 4–6–0 engines. No. 8900, *"Claud Hamilton,"* has a nameplate of the same type as is fitted on the "Pacifics," "Sandringhams" and "Shires." In their new form, the engines have a distinctly smart and neat appearance.

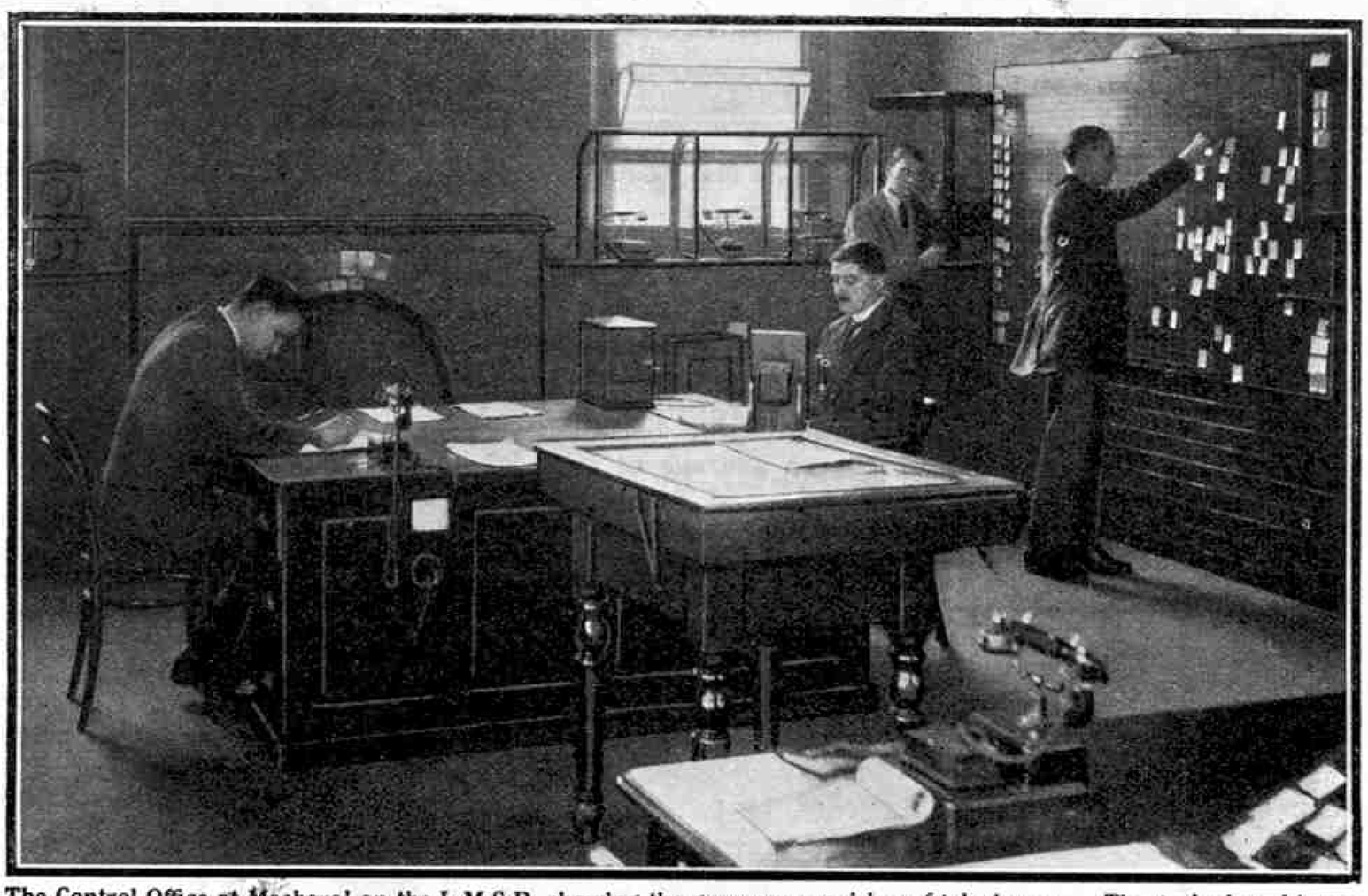
Goods Train Control Systems

A Marvel of Organisation

THE problems associated with the working of goods trains are of a very different nature from those connected with passenger trains. There are many reasons for this but they may be summarised in a few words—passengers take care of themselves, whereas goods require handling.

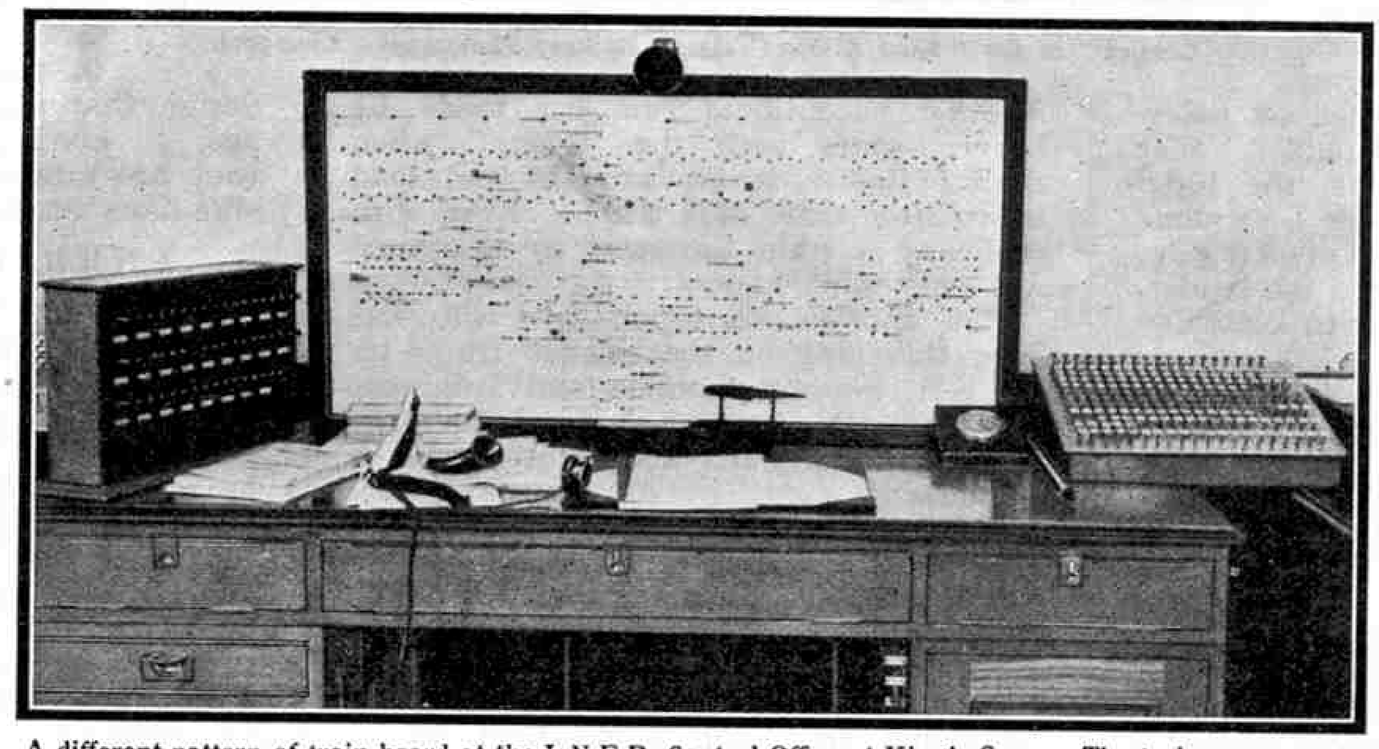
The nature and weight of a passenger train can be predetermined to within a few tons, for the combined weight of the passengers and their luggage is but a small fraction of the whole weight of a train.

Thus it is a simple matter to lay down in advance a schedule for a passenger train of a certain weight to be hauled by an engine of suitable power, with absolute confidence that the schedule will be maintained. The weight of a goods train, however, is subject to fluctuations. The rolling stock provided to carry the traffic is merely the minor part of the load, and the actual load in any wagon may be either considerably greater or considerably less than that of the vehicle itself. In other words, the weight of the average goods train is a matter for speculation until the train is actually made up in the shunting yard and on the point of leaving.



The Control Office at Masboro' on the L.M.S.R. showing the generous provision of telephones. The train board is seen on the right, and one of the staff is engaged in marking up the train movements by means of cards.

Obviously, then, it is extremely difficult to declare with certainty that such trains will maintain schedule on any given run. It is true that schedules are laid down for certain types of goods trains that can and do maintain very fast timings, but these are expresses hauling usually one particular type of traffic—newspapers, fish, fruit, vegetables, etc. Within certain narrow limits the weight of such trains can be forecast with accuracy, and for practical purposes they are treated in the same manner as passenger expresses. They are fitted with automatic brakes and travel at speeds averaging over 50 m.p.h. In considering the general problems of goods working such trains must be left out of consideration as there is nothing difficult or complex about them.



A different pattern of train board at the L.N.E.R. Control Office at King's Cross. The train movements are indicated graphically by means of pegs inserted in sockets in the board.

There are other fast goods trains passing at comparatively high speeds from point to point making connection with other goods trains, and others passing from terminal to terminal. A third class of goods train is that known as "pick-ups," which pass along main lines calling at certain stations to collect traffic. The conditions under which such trains work make it absolutely impossible to lay down a schedule, and it was to meet their special problems that the control system of working was introduced to secure expeditious handling of traffic.

When the Midland Railway opened the first British traffic control office at Masboro' in 1907 the object was to overcome the haphazard working conditions that existed in the Midland colliery area. Up to that time colliery owners had been sending out trains irrespective of the conditions prevailing on the route or at the destination point. Loads were forwarded to ships that were not ready to take in cargo, no attention was paid to the possibility of securing for a train a clear run through to its destination, and the area was continually in a state of congestion.

The effect of this congestion was to create unreasonably long working hours for train crews, who, on account of delays en route, were often on duty for several hours longer than a normal shift—9 to 10 hours at that period—and one of the control office's principal tasks was the elimination of this unnecessary detention. The success of Masboro's early work can be judged from the fact that whereas there were 24,000 cases of unreasonably long working hours in the first six months of 1907, there was not a single case in 1911.

The amazingly successful introduction of traffic control led to the adoption of the system throughout the whole Midland Railway. District controls were instituted at various points to govern local areas, and the individual districts were linked up and unified by a central control office at the Derby headquarters of the company. To-day the Midland Railway forms part of the great L.M.S.R. system, the whole of which—apart from certain "difficult" areas in South and Central Wales and the Scottish Highlands—is worked by district control offices, under the supervision of four divisional central control offices located at Crewe, Derby, Glasgow and Manchester, to cover respectively the old L.N.W.R., Midland, Scottish and L. & Y.R. sections of the group. In their turn the four divisional offices are co-ordinated through a chief control office at Derby, which has, in effect, the entire supervision of every train operation throughout

the system, covering 7,000 miles of track—a remarkable figure.

Each district office is in direct touch by telephone with its central office, various local reporting stations and, by means of special switches, with every station, signal box, goods yard and engine shed in its area. If it is necessary to get into touch with another area, connection is afforded through the central office.

Thus the controller is able to formulate his decisions and transmit instructions rapidly and with the certainty that action will follow immediately. He can order out specials, cancel trains booked to leave, and divert trains to other routes and yards when congestion threatens on their normal routes or in the yard for which they are destined. He can keep a constant hourly check upon surplus rolling stock, transferring it speedily to points where stock is short; and he can call out fresh engine crews to relieve others who have finished their day. In short, with the aid of his telephone and the reports that come flowing into the office, the controller is able to visualise the trains working over his section of line, just as though the actual trains were before his eyes.

In the King's Cross Control Office. A controller is shown supervising movements within the area indicated in the white serrated panel in front of him. This shows a small section of the area covered by the main board in the previous illustration.

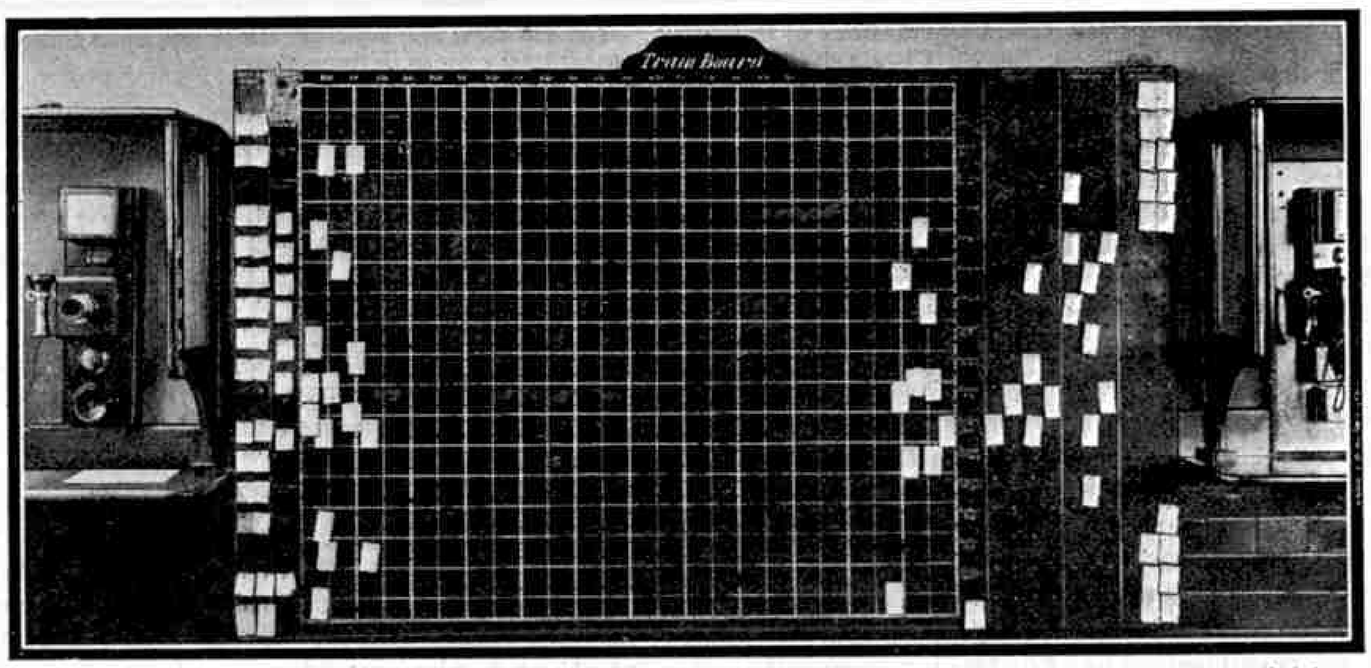
The telephone has revolutionised railway working. Officials hundreds of miles away are, as it were, brought right into the headquarters offices, and decisions that previously could have been reached only after days of correspondence often can be made now in a few hours. Local stationmasters are able to discuss the day's requirements or the incidents of the previous day with their superintendents. The head signalman at a busy junction, instead of being in direct touch only with the signal boxes immediately ahead of or behind his junction, can now speak with signal boxes 15 or 20 miles away, and can ascertain the position of an approaching train long before that train has reached his area. Goods agents now are able to get into touch with industrial concerns and large consignors of traffic in their districts to discover their requirements for the day or the next day and, from the details secured, make all arrangements with headquarters for vehicles to be available.

The first glimpse of a typical control office gives a fleeting impression of rows of telephones and big boards and charts, and these are the bare necessities. Over the lines connecting with those telephones come the reports from the stations and yards up and down the line, and according to what he is told and what he decides to do, the control officer marks his train board, to show the altered situation.

A closer view of the board shows that it is divided by lines running vertically and horizontally down and across the board. The space between each of those vertical lines is divided into five-minute periods, and there are enough spaces to cover 12 hours' working. The horizontal lines correspond with certain reporting stations on the line.

At certain points on the board little white cards are to be seen, and from time to time, as reports come through, these cards are moved. Each represents a train that is passing through the control area, and bears certain details, such as the names of the driver and guard of the train, the time they came on duty, the number of the engine, what train it is working, and the number of wagons constituting the train. Further examination shows that there are two columns on the left-hand side of the board and three on the right. These columns are headed "Out of area" and "Traffic waiting to be moved" on the left; on the right of the board they read "Shunting engines," "Trip engines shunting," "Out of area." Immediately a train is reported to be coming into the control area, a train card is hung upon the board in the appropriate time space and opposite the point at which it enters. As the train proceeds through the section its progress is reported to the controller, and the card is moved from point to point across the board to correspond with the time and place of the last report. If the train is a through train its card is filed away as soon as it has passed out of the area; but if it will be returning later the card is hung in the "Out of area" column to await its return.

In the "Out of area" columns on the board there are already several cards. These probably relate to certain trains that have been advised as on their way to the area, but have not yet arrived. As soon as those trains reach the section their cards will be put on to the board and treated in the way that has just been described. Similarly there are cards in the "Shunting engines" and "Trip engines shunting" columns at points directly opposite certain marked stations. These cards belong to engines that spend the greater portion of their time in goods sidings and shunting yards and working local goods trains, but which are occasionally required to venture on to the main line to pass along to other sidings. Immediately such an engine or train passes on to the line it comes under the survey of the controller and its position must be recorded on the train board.



A close-up view of the train control board at Masboro' on the L.M.S.R. Across the top are time division markings while the stations in the area are shown at the side. Trains are indicated by white cards.

The system we have described is that employed in the Masboro' train control office, and is typical of that operating in the L.M.S.R. district offices. Other railways, of course, have other ideas, and although the principle employed is the same in every case—the visual presentation of trains in the area—the layout of the chart and method of recording progress may vary considerably.

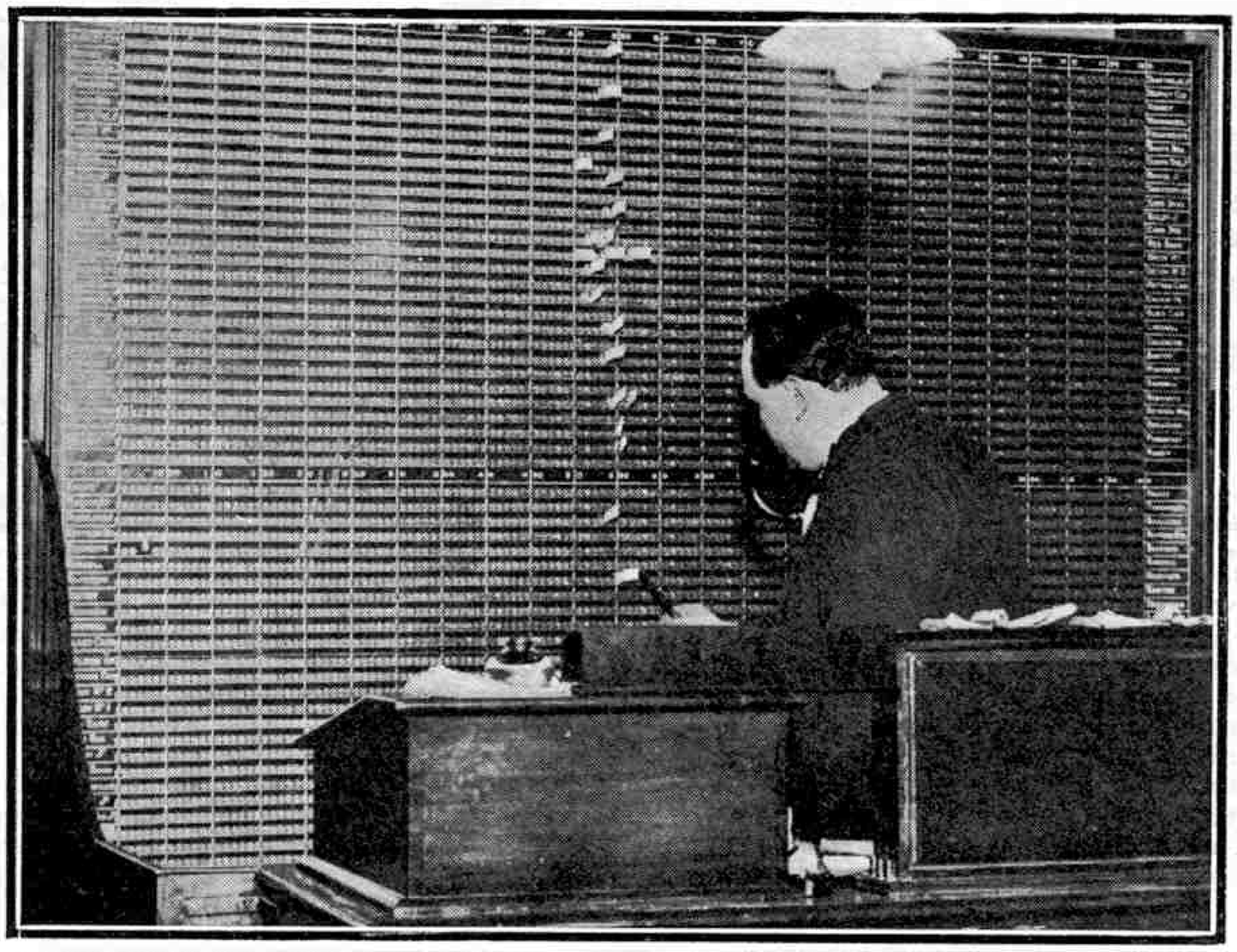
At the beginning of 1923 the London and North Eastern Railway decided upon a system of main line control covering the whole of their East Coast route between Doncaster and Newcastle—a 112-mile stretch that is at once the fastest and most densely operated section of the company's main line—with the object of giving a better oversight of the working of all trains, passenger and freight, on the East Coast main line.

The area is split into three districts, Doncaster-York, York-Darlington, Darlington-Newcastle, but the actual control is worked from a central office at York, with the assistance of eight sub-sections at various parts of the line. Each of the three districts has its train board of the "geographical" type, showing a detailed map of the line in the control district, with the position of every station, signal box, siding and goods yard clearly indicated. Beneath each board there is a telephone switchboard linking up with the sub-sections and other reporting points.

The novel feature of the York installation is a set of five belts driven by a clockwork mechanism actuated by electricity, which move across the train boards at varying speeds representing approximately 15, 25, 35, 45 and 55 miles per hour. The belts move along the front of the boards and round to the back, where they pass over five pulleys of different sizes revolving round a common shaft.

As a train is reported coming into the area, a train card is attached to the belt that most nearly reproduces the average speed of the train ; and as the belt moves across the board and the reports of the train's progress come to hand, it is observed that the speed of the belt gives an amazingly accurate reproduction of the train's actual progress in the area. For example, as an East Coast express comes into the area at Doncaster its card is hung on the fastest belt, and it will be found that the card itself reaches York on the map almost at the exact minute that the train itself reaches York. If the train is scheduled to wait for several minutes in York Station its card is detached from the belt and placed on the train map opposite York Station in the corresponding time column. Then, as the train is reported leaving York on the continuance of its journey, the card goes back on to the belt and continues to record the train's passage.

At the L.M.S.R. Manchester office, which is the old L. & Y. control office, located at Victoria Station, a system somewhat similar to that employed at Masboro' is in use, but here the controller uses a peg for his trains instead of a card. In the control room there are 17 different subsections located and the arrangement is such that as a through train passes along the system it is dealt with by each controller in turn. Thus, as it leaves the area controlled by one man, he fixes his peg into position on the next board at the point at which it enters the next control area, and the controller of that board takes up the supervision of the train.



The train board in the L.N.E.R. Control Office at Doncaster. No less than 160 separate telephone lines converge there, and the office supervises one of the densest traffic areas in the country.

From the foregoing description it is made clear that the train board really gives the controller a complete graphic view of the situation on his section. He can observe the progress of fast trains that are likely to overtake slower trains on the same track, and can instruct his signalmen to shunt the slow train on to a siding or to another line to give a clear passage to the faster train.

The controller's work does not end there, however. Among the reports that come to him are those concerning traffic waiting to be moved, and it is his job to arrange for the expeditious despatch of that traffic. Probably there is an important marshalling centre in his area, and unscheduled trains that must be worked in somehow are continually being reported as approaching readiness for despatch to a certain point.

Immediately such traffic is reported, the controller consults his train chart. This is laid out somewhat on the lines of the board already referred to, but bears heavy lines drawn from point to point to show the timing and route of every scheduled train. In addition, there are various dotted lines. These represent timings and routes—technically known as "paths"—that are available for unscheduled traffic, and which will permit a clear run. Thus, we will suppose the controller is advised by Goods Yard A that it will have a train ready for despatch to Z at, say, 9.30 p.m. On consulting his chart the controller finds a dotted line running from A at 11 p.m. affording a clear path to Z. He books the train accordingly, and proceeds to order out a train crew to take charge of the train.

The traffic controller's connection with marshalling yards does not end with the provision of train crews for traffic waiting to be moved, or the allocation of "paths" to enable such traffic to proceed to its destination. The controller, with his knowledge of the position throughout his area, often can see the possibility of congestion arising at one or another yard. With the position at the remaining convenient yards before him also, he is able to make arrangements for a train destined for a congested yard to be diverted to another yard more easily able to handle the traffic expeditiously. In making such arrangements the controller works in close consultation with the respective yardmasters, who nominally are responsible for all working of trains, inward and outward, to and from their yards.

The co-operation between yardmaster and controller reveals immediately how the regulation of reasonable working hours is secured. Under the old system, a train crew would have taken charge of the hypothetical train we have instanced as soon as it was ready for despatch, and they would have been compelled to wait around for 90 minutes before their journey commenced. It is also the duty of the train controller to observe the length of the period that has yet to be worked by the crew of any train coming into his area. If their shift expires while they are in his area, he must arrange for a relief crew to take over their train.

The actual supervision of rolling stock usually is delegated to an assistant controller. There are approximately 1½ million goods wagons working on British railways, and of these roughly two-thirds are in daily use. It is natural that a surplus of wagons should be on hand at some stations, while other stations have insufficient to meet their requirements. The restoration of a working balance is the rolling stock controller's function. The practice followed is for each reporting station to advise the controller at a stated time each day, usually shortly after 8 a.m., as to the wagons on hand, giving details of empty wagons awaiting unloading, full wagons awaiting despatch, and the anticipated requirement for the day's new traffic. Each station has its own appointed time for reporting to the controller, and consequently the reports follow one another into the office in rapid sequence. Within a few minutes of 8 o'clock, therefore, the controller knows the exact position throughout his area and is able to consult the central control office and make the necessary adjustments.

Control as we have described it here does not begin and end with the operation of trains. The whole of the cartage arrangements in the London area of the old Midland section of the L.M.S. Railway is now supervised by a telephone control, operated from the Somerstown depot by the cartage superintendent, who has under his care 43 districts, each with its own depot. Every carman leaving a depot is under direct supervision, and as soon as his load is collected or delivered he reports by telephone to the controller for further instructions. Thus the work of the whole area is co-ordinated and the avoidance of overlapping results in considerable economy in working.

It is not difficult to appreciate that the results secured by a central control guiding the work of all the various areas must be vastly superior to those obtained by the old arrangements under which some 20 to 30 teams each did its best in its own area. Records of every man's daily work are kept, and at the end of each month they are summarised to show the total time and mileage worked, the tonnage carried and the daily average.

It is obvious that the working of the control system must have had a big effect upon the duties of all other railwaymen, particularly those immediately associated with the working of trains. The signalling staff probably is the most affected, and it may at first sight be thought that the real responsibility of the signalman has been taken from his hands and vested in the controller's. Within certain limits that is true, but the controller's decisions are based upon the signalman's local knowledge. *(Continued on page 461)*

How the Side-Window Cab has Developed

Some Interesting Types and Variations

NOWADAYS it is almost impossible to imagine a locomotive without a cab. In the early stages of railways in this country cabs were unknown, however, and for many years enginemen had to be content with the plain equipment of a "weatherboard." It is interesting to compare this primitive arrangement with the standard set in the familiar double-window cab found on the Gresley "Pacifics" on the L.N.E.R., on which locomotives this type of cab probably finds its best expression. That the ancient and the modern methods are connected may appear surprising, but as a matter of fact the spacious double-window cab, which is usually considered so up to date, is by no means a recent introduction.

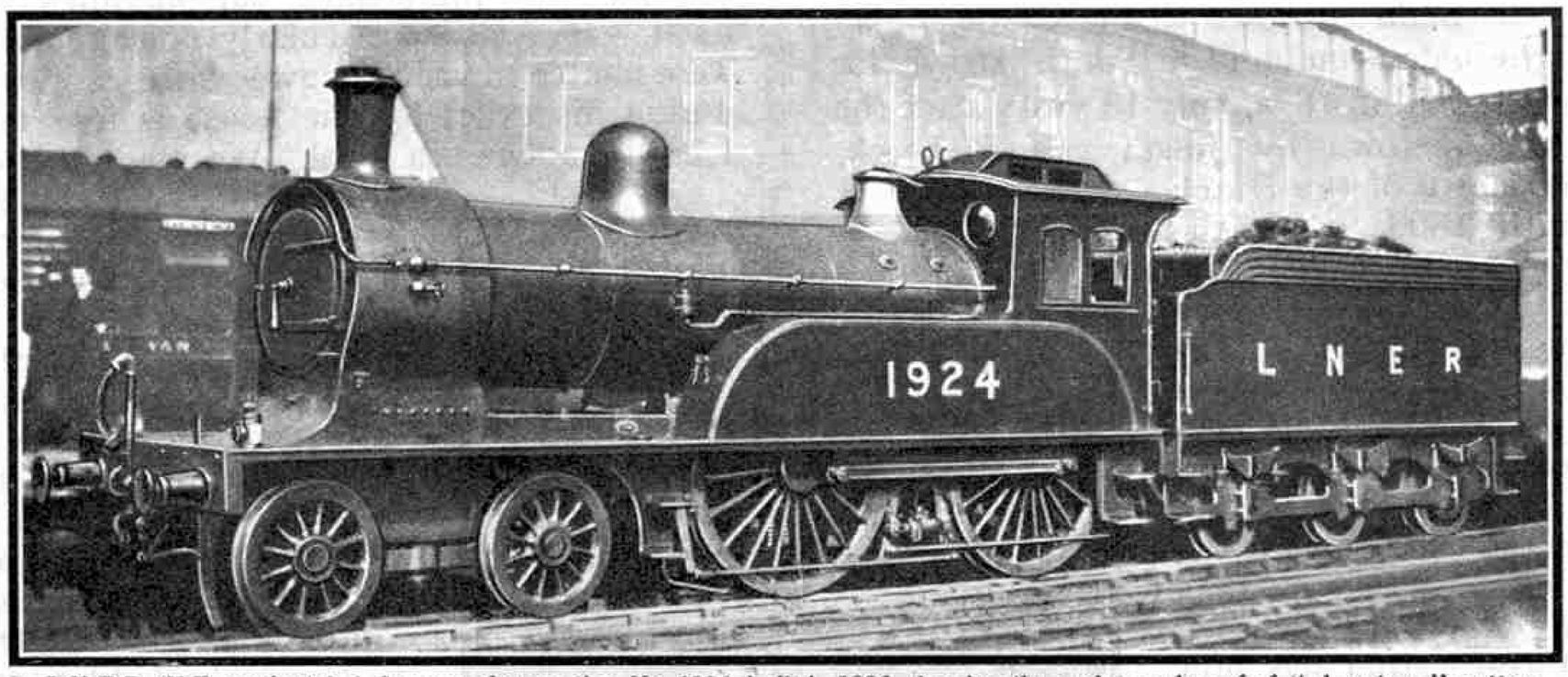
On the earlier locomotives no protection at all was provided, and considerable doubt exists as to where and when the weatherboard was first fitted. It is claimed, however, that it originated in a plank of wood cut to fit the boiler by the enginemen of a locomotive of one of the lines that went to form the pre-group North Eastern Railway. Subsequently metal weatherboards or "spectacle plates" began to be fitted to engines, and later these had their top edge bent over to form what may be regarded as an embryo roof. The prolongation of this roof made necessary the addition of pillars to support its outer end, and then came the addition of side sheets, which in some cases replaced the beams. Many early cabs on Scottish locomotives were shaped as if they had actually developed in this manner, although they had been built complete with the engine in this form. On most railways, however, the arched roof as usually fitted became the rule, and the cab may be said to have then reached in essential features its finished state. Subsequent developments have led up to the cab as used to-day, though there are still in existence many locomotives, mostly of old design, in which the protection might well be improved.

The side-window cab, as we have already remarked, is older than is usually imagined. The well-known engineer Patrick Stirling became Locomotive Superintendent of the former Glasgow and South Western Railway in 1853, and for some time afterwards all the locomotives built to his designs included his pattern of cab in its original form, with one large circular side window. A few isolated examples had appeared elsewhere, but the Stirling pattern on the G.S.W.R. was the only instance of such a cab being standard practice. Later modifications, strange to say, resulted in the omission of the side window, and in a reduction in the amount of protection afforded.

As the circular side window has not been applied to any great extent on locomotive cabs in general, we may consider the pattern with square or rectangular windows as the genuine side-window cab. The first class of British engines to be fitted with such cabs were built for the former Great Eastern Railway in 1876 and were known as "Ironclads." This pattern of cab did not survive long, but it reappeared on this railway in 1900 when double windows were provided in the large and roomy cabs fitted to the 4–4–0 "Claud Hamiltons" of Mr. James Holden's design. This cab subsequently became almost the standard pattern on the G.E.R., and both the 4–6–0 and the large 0–6–0 classes have them.

The first railway to standardise the double-window cab was the North Eastern, which is curious considering that, as we have seen, the weatherboard from which the cab developed is said to have been evolved within the area served by that line. The double-window cab was introduced in 1886 by Mr. T. W. Worsdell. Since that time all the tender engines of the N.E.R. have been provided with it, although in order to restrict the length of the engine certain 4–6–0's of 1899–1900 were provided with a somewhat smaller cab with one side window. The object of this shortening was to enable the engines to be turned on a 50 ft. turntable, but later the cabs were altered to the usual type.

On the engine shown in the accompanying photograph an interesting variation in the shape of the cab roof is to be seen. Many early cab roofs were formed to appear as if they were backward extensions of the weatherboard, and were subsequently replaced by a plain arched pattern of roof. In this case, however, the "clerestory" type of construction is used. This type was also to be found on two engines, Nos. 1869 and 1870 of a similar class to the one illustrated, that were notable for having driving wheels 7 ft. 7¼ in. in diameter, which were the largest coupled wheels in the country. These engines were built in 1896 but some time ago were withdrawn from service. They were known as class "Q1" on the N.E.R. The engine illustrated belongs to class "Q," and is similar in many respects, but the driving wheels are smaller, having a diameter of 7 ft. 1¼ in. Although these class "Q" engines were built more than 30 years ago the cab is quite large and compares well with the standard L.N.E.R. cabs of to-day.



An L.N.E.R. (N.E. section) 4–4–0 express locomotive, No. 1924, built in 1896, showing the curious cab roof of "clerestory" pattern. These roofs are found on several N.E. section and a few G.N.S. section locomotives. For this photograph we are indebted to our reader Mr. D. Foster, Gosforth.

Another feature that was long characteristic of North Eastern locomotive practice is the large continuous splasher. This also was introduced by Mr. Worsdell, for it had been used by him previously on the G.E.R. It remained the standard feature until the larger 4–4–0's of class "R" appeared in 1899, after which separate splashers were used.

On another railway, the Great North of Scotland, which also now forms part of the L.N.E.R., a cab with a "clerestory" roof was provided on several tender locomotives.

The former North British Railway, possibly influenced by the North Eastern whose engines regularly ran into Edinburgh, also adopted the double-window cab on their big "Atlantics." The later 4–4–0 engines of the same line have large cabs with a single side window, with the result that the structure appears rather box-like and uninviting—quite the opposite effect to that seen on the "Atlantics."

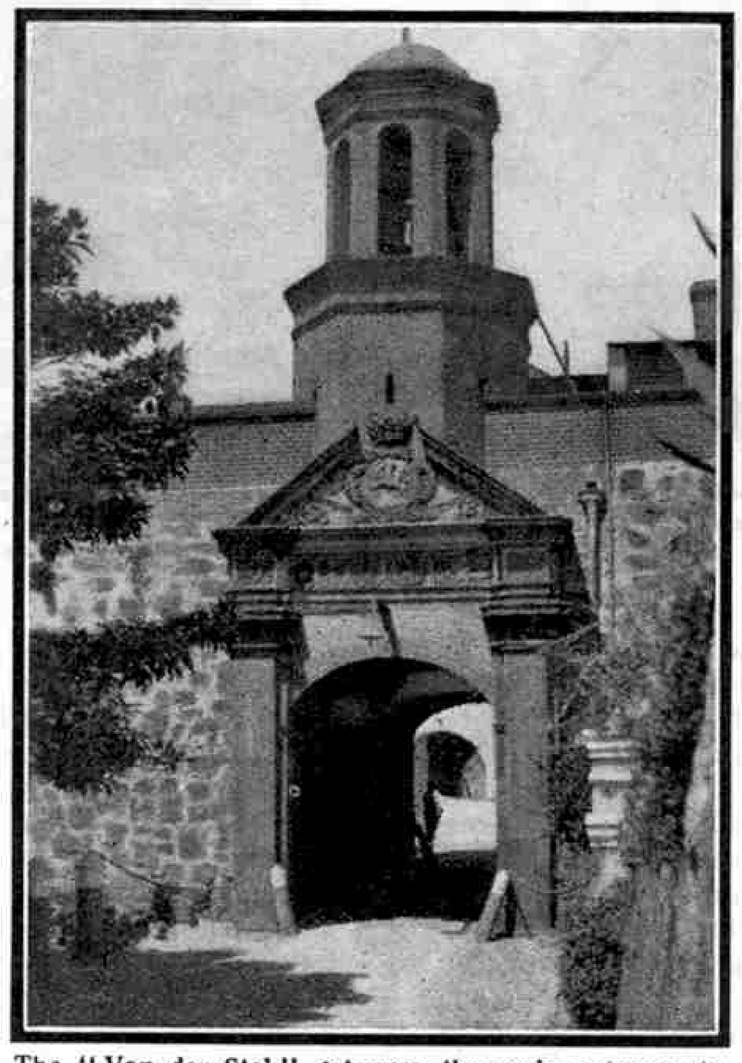
The neighbouring Caledonian also had few engines with side-window cabs. The first Caledonian cabs of this type appeared about 1874, on some curious 0–4–4 tank engines with outside cylinders supplied by Neilson & Company of Glasgow, but the next example was seen on one of the well-known McIntosh 4–6–0 locomotives of the "Sir James King" class in 1906. Later when a superheated series of these engines was built in 1914 this type of cab was provided on all of them, but it was not used on any subsequent engines built by the Caledonian.

These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper only, and they may be accompanied by photographs or sketches for use as illustrations. Articles that are published will be paid for at our usual rates. Statements contained in articles submitted for these pages are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

Capetown's Famous Bell

The accompanying photograph shows the "*Van der Stel*" gateway, the main entrance to the Castle, Capetown. This is the oldest building in South Africa, for its foundations were laid in 1665, only 13 years after the establishment of Capetown by Johan van Riebeeck. It remained the centre of the Dutch Government until 1806, when the country passed under British control.

The bell in the cupola over the gate bears the inscription "*May the land praise the Lord, may it praise Him and exalt Him through all ages, Claudiernime made me in Amsterdam in the year 1679.*" It rang the passing hours for more than 200 years, the practice being discontinued in 1914 because the supports were regarded as insecure. A restoration has now been carried out and the old bell again rings out the message inscribed upon it. J. H. CREDIE (Capetown).



The "Van der Stel" gateway, the main entrance to the oldest European building in South Africa. Photograph by J. H. Credie, Capetown.

A Day in St. Helena

I visited St. Helena last year while on a voyage from South Africa to Southampton in the "*Llandovery Castle.*" My first glimpse of the island came five days after leaving Capetown, when what seemed to be an immense barrier of rock appeared on the horizon. This barrier is broken on its north side at Jamestown, the port of the island, which lies in a valley between two hills, and our arrival there caused great excitement, for a steamer calls only once a month. Even before our vessel dropped anchor in the bay we saw many little boats bobbing up and down in the sea as they were rowed towards us, and more were putting off from the crowded wharf. All were laden with baskets that were hauled aboard and unpacked, revealing hand-made lace, bags and similar articles woven from flax grown on the island, and many other souvenirs in addition to fruit and wooden cages containing "rooibekkies," or "red beaks," tiny brown birds with red breasts and beaks. These articles were quickly spread out on the decks for our inspection.

We went ashore, but as we could stay only until the evening, we were unable to explore the island beyond the immediate surroundings of Jamestown itself. It was particularly disappointing that we were unable to visit Longwood, the residence of Napoleon during his exile, for the house is four miles away and 1,780 ft. above sea level. We made a short trip inland along the steep hilly roads, however, and were impressed by the luxuriant vegetation of the interior of the island.

One of the two hills overlooking the bay is known as Ladder Hill, and is crowned by a Fort to which access is obtained by means of "Jacob's Ladder," a steep ascent of 699 steps that was constructed by the Royal Engineers. The more vigorous visitors invariably attempt to climb the ladder, which is 923 ft. in length and rises 620 ft., but it is so steep that many are unable to complete the venture.

JOSEPHINE HOBBS (Westcliff-on-Sea).

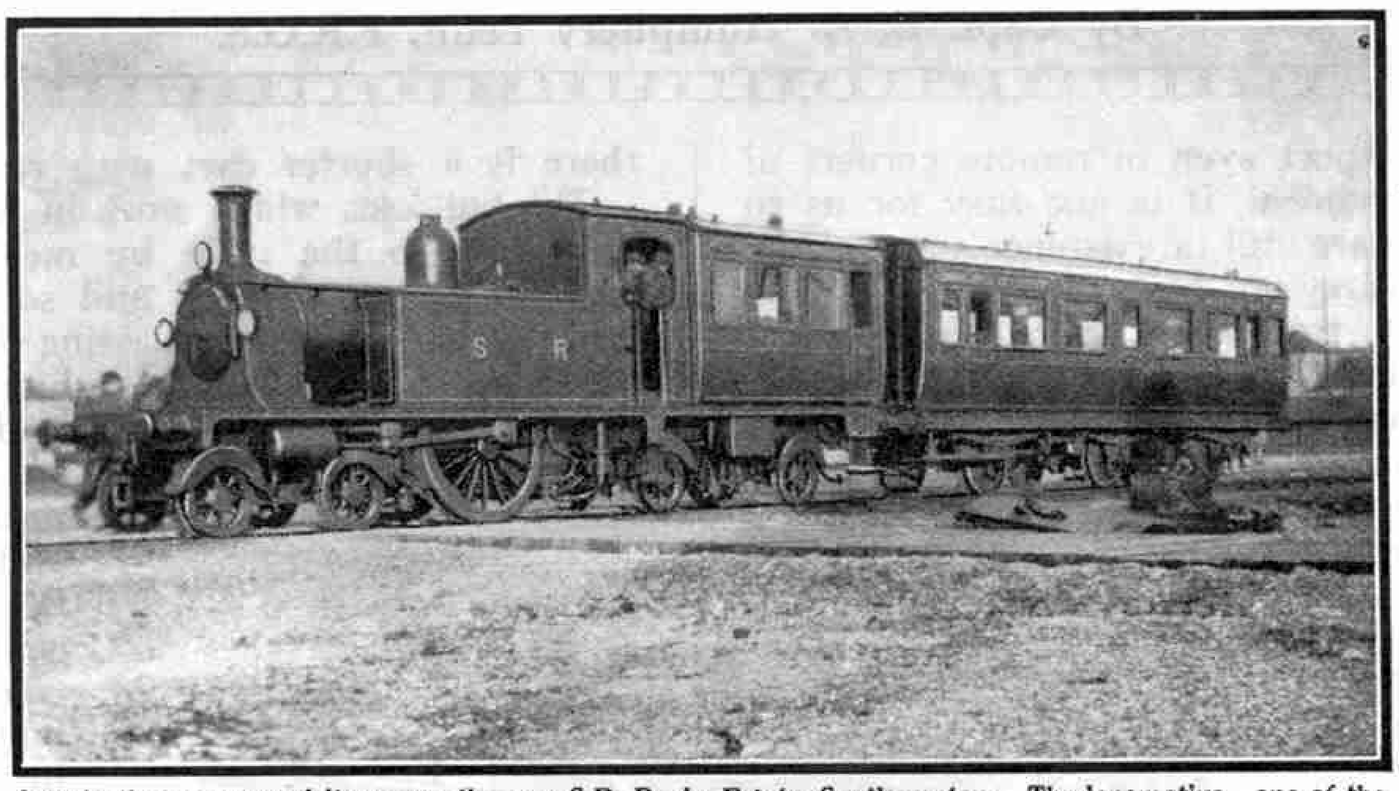
How Matches are Made

When visiting a famous match works I was first shown thousands of aspen poplar logs piled in stacks, and I learned that about 6,000 tons of wood are cut in the factory in a year. The logs are sawn into 3 ft. lengths, and a machine then unrolls from them strips of wood many yards in length and the thickness of a match. The strips are then cut into match splints at the rate of 56,000 a minute, and these are soaked in alum.

The splints are punched into holes in a large belt 400 ft. in length and as this moves along they are dipped successively into baths of molten paraffin wax, and the mixture of potassium chlorate, antimony sulphide, powdered glass and glue that forms the heads. At the end of their tour the matches are punched on to a second travelling belt divided into small compartments. Two other belts moving alongside carry the trays and the covers of the boxes. The matches are pushed into the trays, where the vibration settles them in position, and the covers are slipped on. G. H. SMITH (London, N.4).

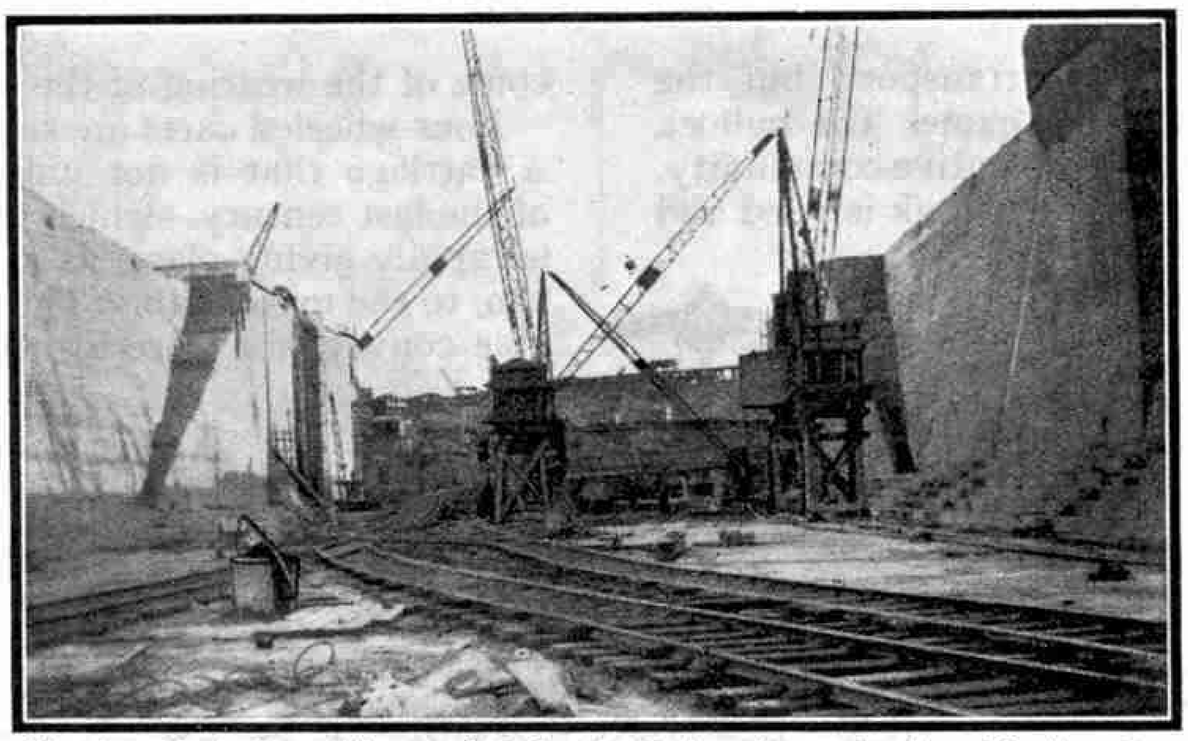
My Visit to the New Southampton Docks

It was with great pleasure that I accepted an invitation to visit the new docks now being constructed by the S.R. at Southampton. On arrival we were taken to the top of the gravel washer and concrete mixer, and from that height obtained an excellent general view of work on the new scheme, in which about 640 acres of ground formerly covered by the River Test are being reclaimed. The pumping station was next visited, and afterwards we proceeded to the new quay wall. This is to be 7,000 ft. in length, and 3,500 ft. already have been completed. The river bed is now at a depth of 46 ft. below low water of spring tides, instead of 12 ft., the depth before dredging operations began; and already giant liners are being moored at this quay. The sheds for passengers and cargo are alongside, each shed being 850 ft. in length and 150 ft. in breadth. The walls of the shed are independent of the roof, which is supported by internal steel columns set in concrete.



A train that conveys visitors over the new S.R. Docks Estate, Southampton. The locomotive—one of the few "single wheelers" remaining in active work—is combined with a coach, and the vehicle was formerly the inspection coach of the Locomotive Superintendent of the L.S.W.R.

We then entered a small train pulled by a light engine with only one pair of driving wheels—one of very few locomotives of this wheel arrangement now left in the country—and proceeded to the new graving dock. This is of immense size, for it is 1,200 ft. in length, 59 ft. in depth and 135 ft. in width. It is constructed of concrete without reinforcement, and the floor and walls are about 25 ft. in thickness. It was found that a layer of sand, highly charged with water under pressure, underlay the site of the dock. This would have been dangerous during construction, and therefore wells were sunk and equipped with pumps in order to remove the water without disturbing the sand.



View from the bottom of the new S.R. Graving Dock under construction at Southampton. The photographs on this page are by H. A. Miles, Southampton.

On completion the giant graving dock will be emptied when necessary in four hours by means of electrically-driven pumps situated in a station now being constructed alongside the dock. A sliding caisson will provide a waterproof gate between the river and the dock. During construction a protective bank has been built outside the dock wall, and this will have to be removed before the caisson is put in its place. The dock will then be flooded to allow the caisson to be floated into position.

After a thorough inspection we were taken back to our starting point in the interesting little train already mentioned.

H. A. Miles (Southampton).

A Pioneer Electric Tramway

Few people know that Ireland claims the pioneer electric tramway. This was constructed from Portrush to Giant's Causeway, about eight miles away, and was opened in 1883.

While staying in Portrush recently I travelled several times on this tramway. The old style of coach is still retained, three forming one tram. The first is open, the second has a roof but no sides, and the third is a closed vehicle for wet weather. The track runs uphill to Giant's Causeway and on the way back the trolley is removed and the vehicles are allowed to run freely.

A journey on the tramway occupies about an hour and many interesting sights are passed on the way. These include the ruins of Dunluce Castle, a feudal stronghold owned by the MacQuillians. This castle was once half a mile from the sea, but the land has been eaten away and the ruins are now on the cliffs overlooking the water. In 1588 the Spaniards fired on the Chimney Pots, part of the Giant's Causeway, in mistake for this castle. Out at sea may be seen a red triangle marking the spot where a number of galleons of the Armada went down. The bodies of their crews were buried in the tiny churchyard just inland.

A curious formation of rock is called the Giant's Head and another the Lion's Paw. Just beyond Dunluce is the spot where a German submarine attacked a trading vessel, the "*Wheatear*," in May, 1918. One of the tramway wires was cut, but the British vessel managed to escape.

M. Pocock (Liverpool).

A Deserted Spa

At Stoney Middleton, a quaint old-fashioned village in Derbyshire, is a deserted building that at one time housed many invalids seeking relief from rheumatism and similar ailments by bathing in the tepid water of a medicinal spring. The water at Stoney Middleton is said to be similar in composition to that at Buxton. Its virtues were known to the Romans, and Roman baths can be traced near the spring. The bath erected more recently is still in fair condition and full of fresh water, for the flow of the spring is so copious that the bath would fill again in a few minutes if it were emptied. It appears to have been in use as late as 1875.

W. C. Wilkinson (Sheffield).

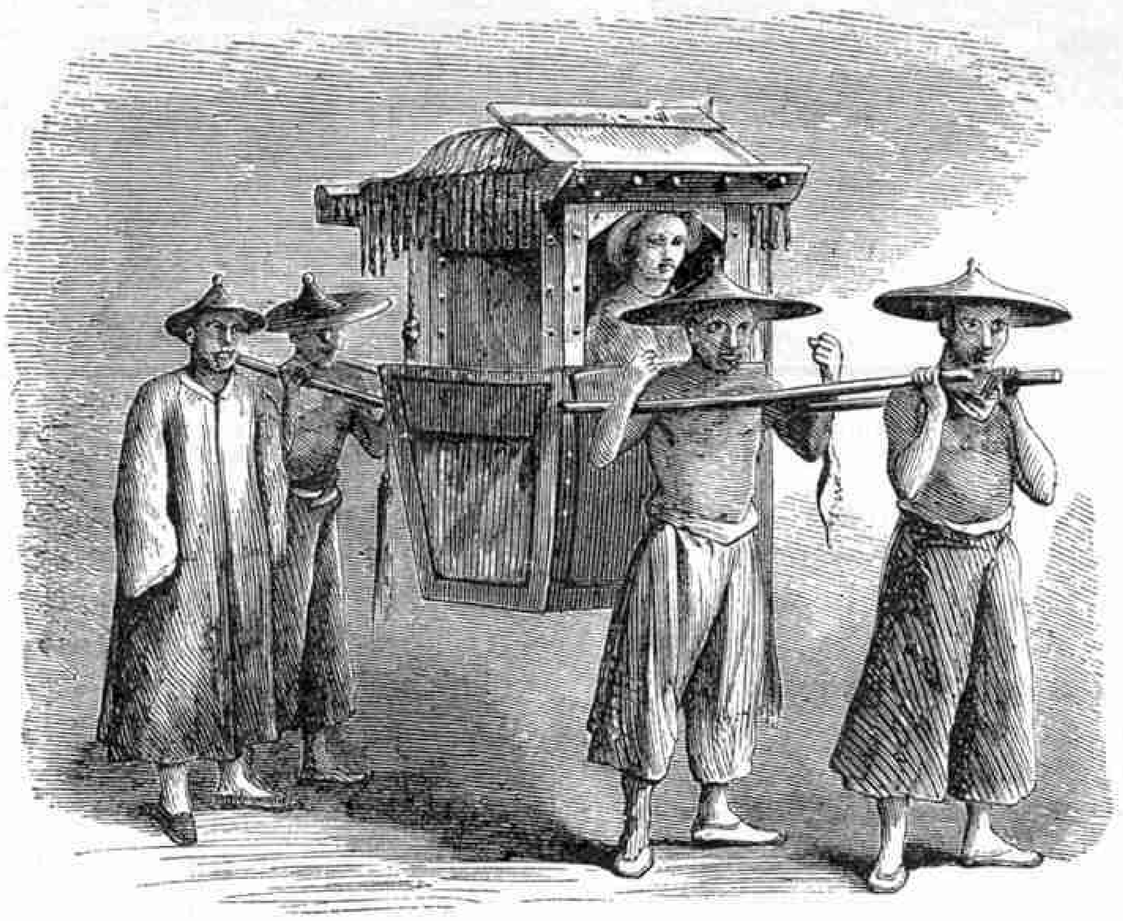
Some Curious Modes of Transport

Interesting Survivals of Ancient Methods

By Capt. E. A. Humphery Fenn, F.R.G.S.

TO-DAY, when transport even in remote corners of the earth is mechanical, it is not easy for us to realise that there are still in existence some of the earliest methods of carrying both people and merchandise. The British trackways, which for several centuries before the birth of Christ formed the only means of inter-communication between the tribes then inhabiting this island, once echoed with the rumbling of the crazy carts of Caradoc and Boadicea. The Roman chariot, too, was the precursor of many a vehicle used in mediæval days before the coming of the coach and of mechanised locomotion. Older than any of these, however, are the methods of transport still in use in the East and in Africa.

India still retains many of the forms of transport that have been used since the dawn of history. Western civilisation has introduced the railway and motor transport, but the beast of burden—the elephant, the camel, the bullock and the ass—may still be seen in every native community. The elephant is used for heavy work. Teak is piled and towed by these living tugs, the powerful and sagacious descendants of the mammoth. The camel is used both for riding and for hauling wagons. In one of the accompanying illustrations it will be seen as a pack-animal bearing fodder on its back. It is also often used to haul loads of cotton alongside the quays of the ports.



Travelling by sedan chair, a form of transport that may still be seen in China. (From an old print.)

Bullock carts are found almost everywhere in India and Burma, as indeed they are in many Asiatic and also European countries. The Indian bullock cart varies in design according to the district and to the purposes for which it is intended. In cotton-growing districts a long platform-type of wagon is used. In the districts where stone is quarried a very low platform cart is found, having solid untyred wood wheels, with a very crude form of axle. For grain and other merchandise there is a shorter cart with railed ends and sides.

The bullocks, which work in pairs, are shod, and are harnessed to the yoke by means of a leather strap passing under the neck and so back on to the yoke. Each animal has a rope passing through the nostrils and joined behind the head, and continued in one rein to the driver. By this means the cart is steered and controlled, the driver being seated across the centre pole. The uneven traction caused by the pull of the steering, and by the narrow tyre of the wheel, has a severe wearing action on the road surface. The wheels are all noticeable for the depth of the rim, and their strength lies in this rim rather than in the spokes, which are comparatively light. The yoke is attached to the pole by a rope, and an iron pin is used to transmit the pull. The hump of the animal is considered to be the outcome of the wearing of the yoke during many centuries.

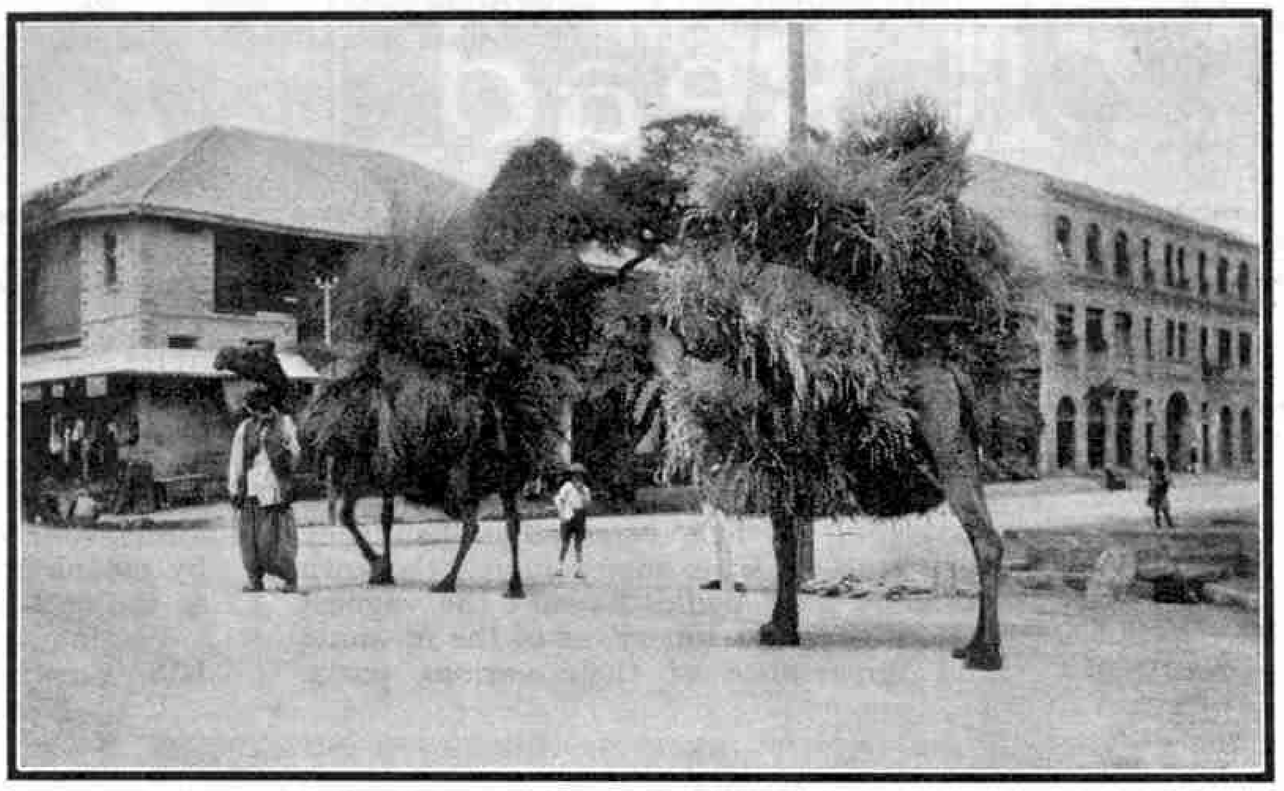
Four-wheeled carts are seldom seen in native districts. A carriage that is not unlike the English "Victoria" of the last century—which undoubtedly is a copy of it—is rapidly giving place, as it did in England many years ago, to the motor cab. The rickshaw is still the fashionable conveyance in residential districts. It is a wicker cart on two wheels drawn by two or four "runners." In some parts of India the one or two-horsed "tonga" is used. The animals that draw it are an indifferent breed of pony, and they are harnessed to it by means of a yoke attached to a heavy saddle-piece. The one-horsed tonga, when privately owned, is often a very smart affair, having rubber-tyred wheels, a leather or canvas awning, and a loud pedal-operated bell that is used constantly. It is not unlike the English dog-cart of pre-motor days.

In China the wheelbarrow is employed for persons as well as goods, and this quaint drawing shows a farmer's wife going to market by this means.

In up-country districts both bullocks and asses are used as pack-animals. They are laden with sack panniers, and are handled in herds, often by a woman or a boy. In the

hill districts throughout India heavy loads are carried by coolie men and women, either on the head, or on the back, slung to the forehead.

The " Jagganath " cars of Puri on the east coast of India are huge, ponderous vehicles, grotesque and unwieldy, and barbaric in construction and decoration. The cars are 45 ft. high, and have 16 huge wheels, 7 ft. in height and placed in pairs. The steering is difficult, and the cars pursue an uneven course. An effigy of the god Jagganath occupies the highest position, and the most gaudy and grotesque ornaments are used.



Camels transporting loads of forage in India.

In China much of the transport is waterborne up and down the great rivers. There, however, as elsewhere in the East, there exist many strange and primitive methods of conveyance. Sedan chairs, once popular in England, may still be seen in China. In the case of a civilian these are carried by two or three men ; high officers often have four bearers, and the highest rank may have as many as eight. Military officers and civil mandarins often ride through the streets on ponies. The streets are narrow and crowded, and a boy or groom runs in front crying out : " Horse ! " " Horse ! " to clear the way. The bridal sedan chair is always red. It is borne by four men wearing caps with red tassels, and the musicians and all the other people in the procession have similar caps. In a funeral procession a sedan chair is provided for the use of the spirit of the dead, and on it is perched the sacred crane to bear the spirit to Paradise. It is believed that the spirit prefers riding to walking as a means of transport into the next world !

The sedan chair was never popular in Pekin, a one-horsed cart, with an awning for both driver and horse, being usually preferred. This vehicle, which was known as the " Pekin cart," was slow-moving and uncomfortable, and in appearance not unlike a miniature covered wagon.

The wheelbarrow is a familiar sight in China. It is employed for persons as well as for goods, but is primarily used for goods, and a coolie will manipulate in one a very heavy and bulky burden. Here, as in other parts of the East, coolies carry surprisingly heavy loads for long distances upon their shoulders or heads.

In Java there is to be seen a curious one-man travelling restaurant. Across the man's shoulders is balanced a pole. At one end of this is slung the " kitchen," a stove complete with fire ; and at the other end hangs the basket containing the food and the various utensils. The stove is not unlike a crude imitation of the " hot chestnut " vendor's outfit with which most of us are familiar. With this portable restaurant the man goes from village to village, finding a ready sale for his wares, which are very popular with the native population.

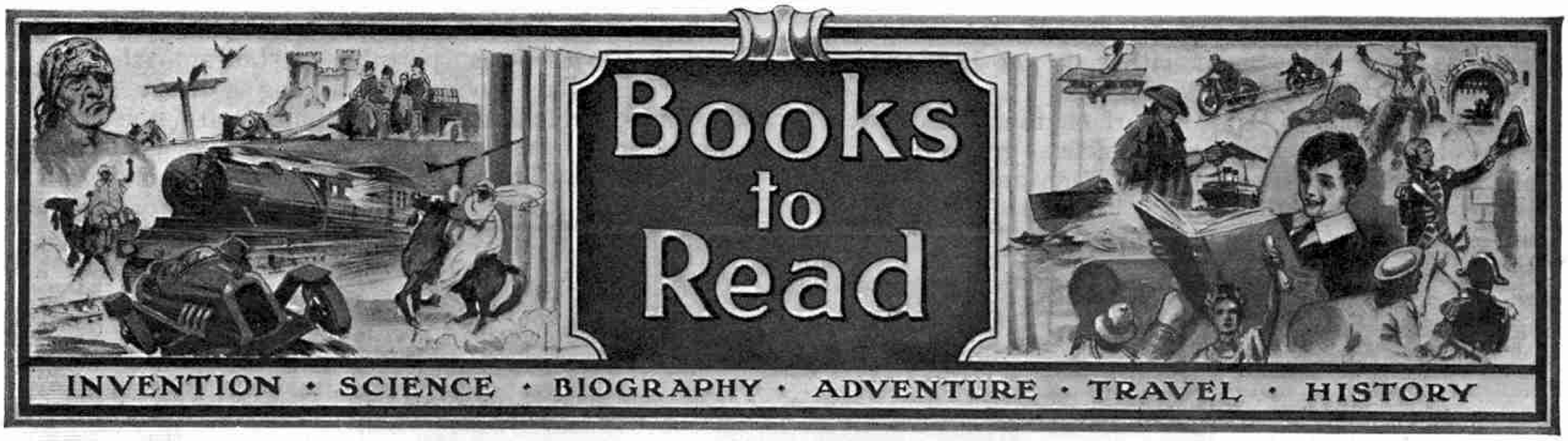
The custom of carrying goods on the head is common to all the native peoples of equatorial Africa. In Sierra Leone, too, everything is carried in this manner, cushions or mats called " cattas," made of grass or straw, being used to protect the head. When wheelbarrows were first sent out to this colony, their use was carefully explained to the natives, but these preferred to carry the barrows on their heads to using them in the orthodox manner ! Heavy articles, such as casks and crates, are slung on poles of bamboo that are borne on the shoulders of one or more persons, according to the weight and size of the burden.

Even the mechanical transport of modern times, eloquent of the skill of the engineer, provides, where the situation demands it, freak methods of transport. An interesting example of this is to be found in the overhead tramway of Melk in Austria, which is operated by cars suspended from cables strung high above the valley and the mountain side. From these cars may be obtained a wonderful bird's-eye view of the valleys and the mountains ; the experience in fact is similar to being in an aeroplane. Perilous enough it would seem, but the strength of the cable is such as to render any mishap an extremely remote possibility.

An overhead cable mountain tramway at Melk, Austria.

The Kohlerer Mountain Railway in the Austrian Tyrol provides another interesting instance of a railway cableway that serves as a regular means of transport. Lofty steel towers carry the cables from the valley to the summit of a mountain 4,000 ft. high. There are only two stations on the route, one at the base and the other at the summit. Shortly before the War an aerial line was built to the edge of the Wetterhorn, its object being to raise passengers some 2,000 ft. to the Upper Glacier. Owing to the War this project failed to pay its way and to-day its cables and machinery are disused and covered with rust.

Thus, throughout the ages, Man has succeeded in overcoming all difficulties in the way that leads from place to place ; and his ingenuity has never failed to provide him with means of transport that sufficed for his needs, however strange such means may appear to those to whom they are unfamiliar.



Here we review books of interest and of use to readers of the "M.M." We can supply copies of these books to readers who cannot obtain them through the usual channels. Order from Book Dept., Meccano Limited, Binns Road, Liverpool 13, adding 1/– for postage to the price. Postages on different books vary, but any balance remaining will be refunded.

"The Court-Martial of the '*Bounty*' Mutineers"

By Owen Rutter, F.R.G.S. (Wm. Hodge & Co. 10/6)

This book, one of a series entitled "Notable British Trials," is an account of the Court-Martial of the "*Bounty*" mutineers. The episode, although in itself of no peculiar importance in naval history, was the cause of one of the finest feats of navigation in the annals of the sea, and led also to the foundation of a British settlement that is in existence to-day.

In 1787, the "*Bounty*," under the command of Lieutenant Bligh, was sent on a special mission to Tahiti to secure a collection of bread-fruit plants for the West Indies. Trouble was brewing during the three months' stay on the island, Bligh's overbearing disposition making him unpopular with most of the crew. In addition, he had a series of clashes with Fletcher Christian, one of the master's mates. On the homeward voyage, three hundred miles out from Tahiti, the mutineers, led by Christian, forced Bligh and eighteen of the crew into an open boat and turned them adrift. Six weeks later Bligh brought the boat to Timor—a remarkable feat of navigation.

Meanwhile, the mutineers had returned to Tahiti, where fourteen of them elected to remain. The rest, under Christian, sailed away in the "*Bounty*" and later settled on Pitcairn Island. In due course H.M.S. "*Pandora*" was despatched from England in search of the mutineers, and apprehended those who had remained on Tahiti. On 12th September 1792, they were court-martialled on board H.M.S. "*Duke*," and this book gives the evidence in detail. As a result, four were acquitted and the remainder were sentenced to death. The Christian party escaped capture, but, with the exception of two of their number, all met with untimely deaths on Pitcairn Island.

Captain William Bligh of the "Bounty." (From "The Court Martial of the 'Bounty' Mutineers," reviewed on this page.)

"Living Machinery"

By Professor A. V. Hill, D.Sc., F.R.S.
(G. Bell & Sons, Ltd. 4/6 net)

Few men are so well equipped as Professor A. V. Hill in regard to scientific attainments of the highest order combined with the ability to explain complicated processes in a simple manner. "*Living Machinery*" consists of six Christmas lectures delivered at the Royal Institution, London, dealing with the machinery of the body. In his introduction Professor Hill says: "Most people who own motor cars know very little about the insides of them and how they work; which is distressing enough, especially when they go wrong. How many more who own perfectly good bodies haven't the vaguest idea of their machinery, or of the meaning and importance of their various parts. In these six lectures I shall try to give you some idea of the working of two of the most important parts of the body: the muscles which move it about, and the nerves which arrange where and how it shall be moved. If you begin to understand these you will know enough to make you want to understand a lot of other things too."

The lectures are veritable storehouses of information, but they are far from being mere collections of facts. We are led on from one item of knowledge to another in the most interesting fashion, and never for an instant are we allowed to feel bored or out of our depth. The first lecture deals with the nerves and the messages they carry, and we learn that a nerve is made up of hundreds of long fibres, each about one-tenth of the thickness of a human hair. Each of these fibres, of which there are millions in the body, has an inside and a covering like that of an insulated electric wire. A nervous impulse or message is a wave of electro-chemical change passing along the fibres, and the message can be recorded by means of a delicate instrument known as the cathode ray oscillograph.

Passing on to the muscles, Professor Hill surprises us with their strength. "Even the isolated muscle of a frog," he tells us, "which is not a very strong animal, can exert quite astonishing forces: it may easily lift a thousand times its own weight." The voluntary muscles, that is those that respond to the will, moving our limbs when we wish them to, or holding them fast if we so desire, differ very greatly from one another in speed. "The slowest cross-striated muscle known is one which works the gastric mill of the crayfish. The stomach of the crayfish has a machine for grinding up his food, and this machine is worked by a muscle which may take half a minute or more to give a single twitch. Even the leg muscles of the tortoise, especially after he has been having his winter sleep, may be very slow. I once met a tortoise whose *biceps cruris* muscle took more than half a minute to complete a single contraction. At the other end of the scale we come to some muscles of amazing quickness—those that work the wings of insects . . . In the case of some of these insects the wings are going 300 times or more per second, 10,000 times as fast as the crayfish, or that particular tortoise I referred to."

It is specially interesting to note that the efficiency of a muscle, measured by the ratio of the mechanical work it can do to the energy of the fuel with which it is provided, may be 25 per cent. or more. This compares very favourably with the mechanical efficiency of engines, which ranges from about 7½ per cent. in steam engines without condensers and 9 to 19 per cent. in those with condensers, to 14 to 28 per cent. in gas engines and 29 to 35 per cent. in Diesel engines.

Professor Hill deals at length with the interplay of nerves and muscle-fibres that is seen at its best in various sports, and explains the American system of electric timing for runners.

The half-tone illustrations and diagrams with which the book is illustrated are well chosen, and of particular interest is a series of 15 exposures illustrating the movements of a cat when falling after being held feet upward and suddenly released.

"Old Trades and New Knowledge"

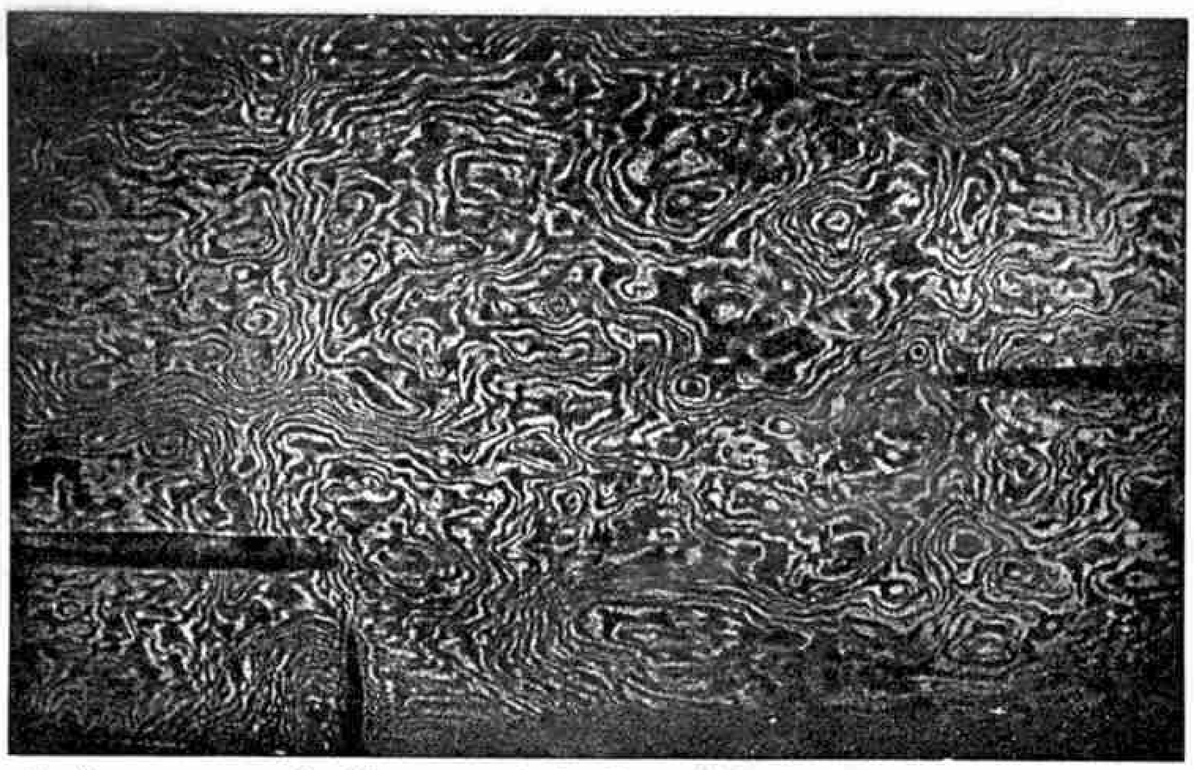
By Sir W. H. Bragg, O.M., K.B.E., F.R.S.
(G. Bell & Sons Ltd. 4/6)

Here is the story of how the application of new knowledge to the ancient crafts of the sailor, the smith, the weaver, the dyer, the potter, and the miner, has helped in many wonderful ways. In the chapter dealing with the smith we are told that "the working of metals goes back to a time so long ago that we have no clear record of how the trade of the smith first began . . . . the development of man's powers has depended very largely on the use of metals so that the smith has at all times been in continual demand. . . ." Although these ancient metal workers knew that the properties of metals and alloys depended on their composition, and that some were soft, others hard; that some rusted, others did not, the new knowledge brought to bear on this trade has taught us what the ancients did not know—that the properties of any metal or alloy depend on the way in which its atoms are arranged; and that modification by heat or mechanical treatment—such as hammering, rolling, and drawing—alters the arrangement of these atoms.

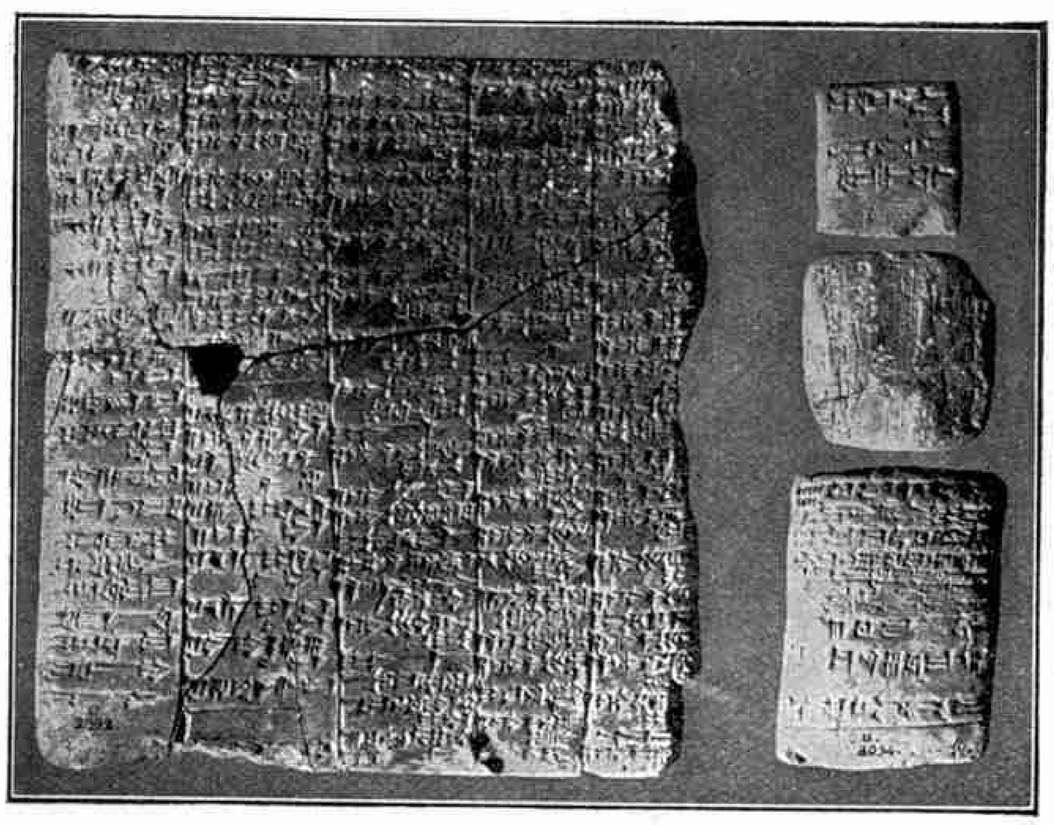
Our new knowledge enables us to see the reasons for the difficulties that the old craftsmen met with, and why they sometimes succeeded and sometimes failed. Moreover, the work of the smith has been greatly extended by the discovery of many new alloys and of the exact ways to treat them so as to obtain wished for results. In the making of swords, great skill and patience were necessary before a sword maker was consistently excellent in his products. The famous Damascene steel, which came from India by way of Damascus, was a steel that contained much carbon. The pliability for which it was famous was obtained because the smith had to heat the metal in a little furnace, in which he had to place it time after time so as to forge and mould it into shape with his hammer. The curious appearance of the steel (shown in the accompanying illustration) is due to the presence of innumerable light-coloured specks of cementite, arranged in layers that are formed during the making of the steel.

Sir William Bragg is careful to tell us that the book is "meant to have a moral, in that there is much more than fascination in the history of men's work; there is also the plain and urgent lesson that we must continually improve our handicrafts by means of the new knowledge, which is always flowing in. We, of all nations, have to make our living by trading the work of our hands for food, and that which we make must be so good and interesting that other nations are anxious to trade with us. Also, there is an ideal which may seem far beyond us, and yet must always be aimed at; it is this, to give everybody work to do, and make everybody enjoy doing it well."

The book is full of interesting facts, and particularly for readers of the "*M.M.*" The illustrations are both numerous and good. The only thing lacking is an index.



Markings on a sword of Damascus steel. (From "Old Trades and New Knowledge," reviewed on this page.)



The largest of these Sumerian clay tablets, found at Ur, is a balance sheet of a factory and gives a list of the women weavers employed, their rations for the month, and the amount of cloth made. The tablet at the top on the right is a receipt for one sheep. (See above.)

"Television for the Amateur Constructor"

By H. J. B. Chapple, B.Sc., A.M.I.E.E.
(Pitman & Sons Ltd. 12/6 net)

The broadcasting by the B.B.C. of regular television transmissions has aroused widespread interest in this fascinating branch of radio work, and there is undoubtedly a growing demand among amateurs for advice and instruction on the building of home-made television sets. Radio owes much to the experimental work of amateur constructors in its early days, and there is no reason why similar good results should not follow amateur interest in television. This book has been written with the special object of helping amateurs to make a start in constructional work.

Mr. Chapple begins with a summary of the general principles of television, and explains the parts played by the scanning disc, the neon lamp, and the synchronising mechanism. Then follows a preliminary chapter on the tools required in making radio and television receivers, giving valuable hints that will help the reader to arrange a simple but efficient workshop. The design of a radio set for television reception must fulfil definite conditions if good results are to be obtained, and the author gives full directions for the construction of a special receiver, and also advice on adapting existing commercial or home-made receivers to the needs of television. There are also interesting suggestions for experimental circuits by means of which full advantage may be taken of the television signals now being transmitted. Another useful feature is an account of the construction of various types of eliminator designed to provide the necessary high-tension power from A.C. mains.

Two types of television apparatus are described and explained in full. The first of these is intended for the beginner, and includes a proportion of parts supplied by Baird Television Ltd. The second is more ambitious, in that the scanning disc and other important parts are to be constructed by the amateur himself. The greatest care and accuracy is necessary in work of this kind, but the clear and practical directions given by the author for making the parts, and also for testing their performance, will keep the constructor on the right lines. There is a very large field before the experimenter in television, and the final chapter of the book that suggests possible lines of development will give the amateur constructor valuable hints for useful work of an original nature.

The usefulness of Mr. Chapple's excellent book is increased by the large number of plates and explanatory diagrams.

"Boy Scout Tests and How To Pass Them"

(Brown, Son & Ferguson Ltd. 4/6 net)

Every good Scout is eager to earn proficiency badges, partly as a proof of his keenness in Scouting, and partly because of the pleasure derived from the ability to carry out the practical tasks involved in preparing for each badge. This book provides a vast amount of information that a Scout should possess. The instructions are based on the 1933 tests, and candidates for badges will have to qualify under the latest conditions laid down. Full instructions are given for the Tenderfoot Test, the Second-Class Test and the First-Class Test; and there are chapters on 68 different badges, ranging from the Airman Badge to the World Friendship Badge. It is not expected that Scouts will be able to qualify for badges merely by reading the appropriate section, but if, as suggested in the preface, the book is supplemented by further reading and by practical work under competent instructors, it will prove a splendid guide.

New Books

The undermentioned books, recently published, will be reviewed in a future issue.

How to Arrange and Write-up a Stamp Collection
by Phillips and C. P. Rang (Stanley Gibbons, 2/6)

The Home of Mankind
by Hendrik Van Loon (Harrap, 12/6)

Stellar Wonders
by Charles Whyte (The Sheldon Press, 5/-)

How to Find Out
by Lionel McColvin (Humphrey Toulmin, 2/6)

How to Use Books
by Lionel McColvin (Humphrey Toulmin, 2/6)

A Scouter's Book of Ideas
by Robert Morrison (Brown, Son & Ferguson Ltd., 1/6)

HORNBY SP

HORNBY SPEED BOAT No. 1. "MARTIN."

Hornby Speed Boat No. 1 is a very efficient model, measuring 8½ in. in length and 2⅜ in. in beam. It will travel over 160 feet on one winding. Finished in three different colour combinations—Red and Yellow, Blue and White, and Orange and Green.

PRICE 5/-

Get a Hornby S

Perfect Design—Exceptio

Nothing like the new 1933 Hornby Speed Boa
They are superb ! Each model follows closely the desi

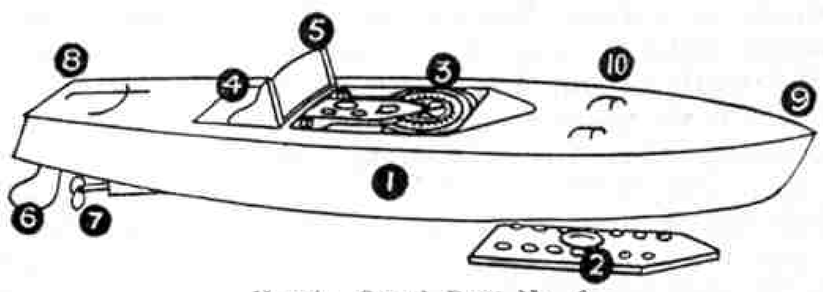
The beauty of their appearance and the efficien
enthusiasts everywhere. Here are some of the sp
fine entry lines of bow giving great speed ; exception
by which the boats are propelled ; special design

This is Hornby Speed Boat No. 3, "Condor"

Hornby Speed Bo

SPECIAL FEATURES

(1) *Beautifully made hull, with watertight compartments. Available in a selection of rich colour combinations.*
(2) *Removable engine hatch giving access to motor.*
(3) *Powerful spring motor giving great length of run.*
(4) *Separate cockpit.*
(5) *Real windscreen.*



Hornby Speed Boat No. 3

(6) *Adj*
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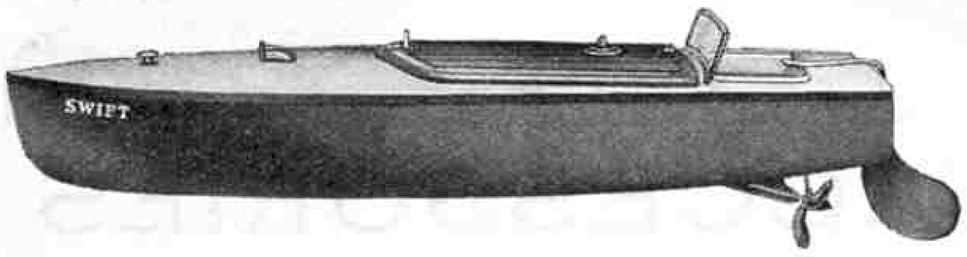
Manufactured by MECCANO LIMITED — BINNS ROAD —

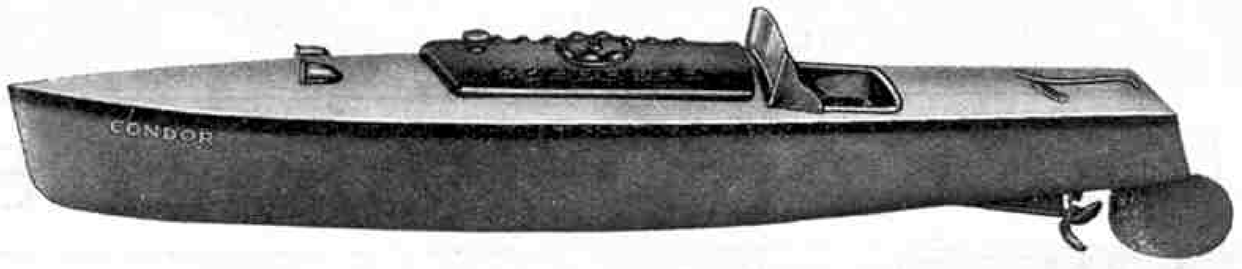
PEED BOATS



HORNBY SPEED BOAT No. 2. "SWIFT."

The exceptionally fine performance of Hornby Speed Boat No. 2 makes it one of the most popular of the Hornby models. It will travel over 300 feet on one winding. Finished in three different colour combinations—Red and Cream, Blue and White, and Yellow and White. Dimensions : Length, 12½ in. Beam, 3 in.

PRICE 7/6



HORNBY SPEED BOAT No. 3.

Hornby Speed Boat No. 3 has already established itself as a great favourite. It will travel over 500 feet on one winding. Available with three different names and in three different colour combinations, as follows :—**" Condor "** (Red and Cream), **" Gannet "** (Blue and White), **" Curlew "** (Green and Ivory). Dimensions : Length, 16½ in. Beam, 3½ in.

PRICE 12/6

odel, will three Blue

Speed Boat Now

ptional Performance—Beautiful Finish

ed Boats has been known before in model speed boat construction. he design and general characteristics of the world's famous speed boats.

fficiency of their performance are the talk of thousands of speed boat the special features of these wonderful boats—streamlined hull and ceptional length of run, due to the general excellence of the mechanism design of propeller ; attractive finish with a special patent water resisting enamel in a range of choice colour combinations.

There are five splendid models in the series ranging from 5/– upwards. Ask your dealer to show them to you, or send to us for a copy of the Hornby Speed Boat leaflet in colours.

Even the smallest of the Hornby Speed Boats (No. 1, 5/–) has a most unusual speed and length of run. Under test this model has run for three minutes over a distance of 170 ft. giving an approximate speed of 1 ft. per second. This is a unique performance and we invite you to compare it with any other type of model speed boat on the market.

Get a Hornby Speed Boat to-day, and be first to smash records on your local pond !

Boats are Race Winners!

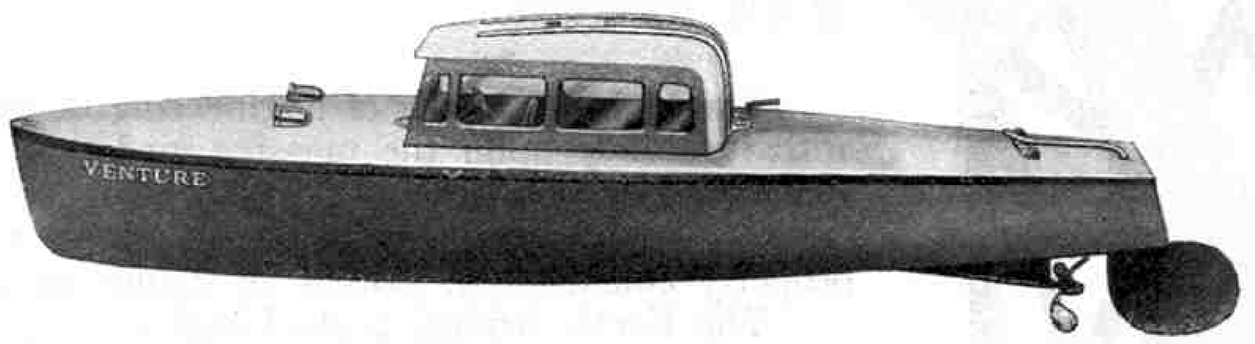
Adjustable rudder with ratchet tiller rack.

Scientifically designed triple blade propeller giving maximum power and speed.

and (9) *Bow and Stern flag sockets in Speed Boats Nos. 3 and 4.*

Ventilators.

LIVERPOOL 13



HORNBY LIMOUSINE BOAT No. 4. "VENTURE."

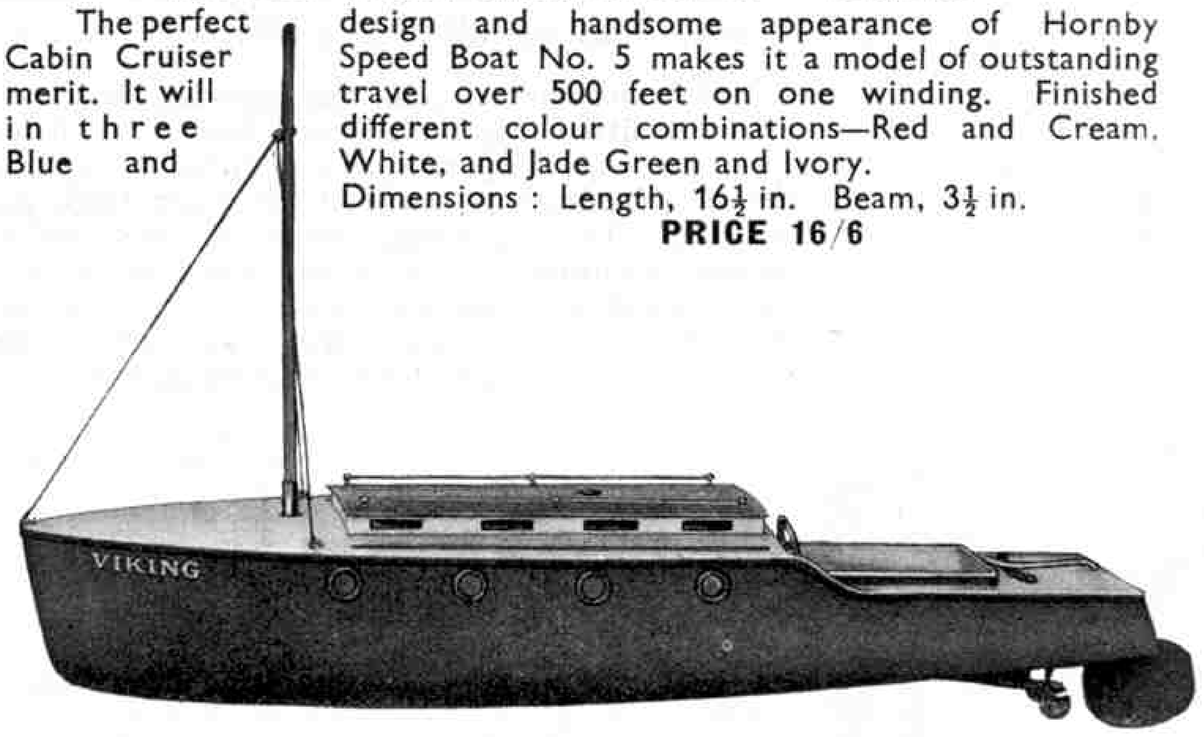
This realistic Hornby Limousine Speed Boat No. 4 is a magnificent model. It will travel over 500 feet on one winding. Finished in three different colour combinations—Red and Cream, Blue and White, and Jade Green and Ivory. Dimensions : Length, 16½ in. Beam, 3½ in.

PRICE 15/6

HORNBY CABIN CRUISER No. 5. "VIKING."

The perfect design and handsome appearance of Hornby Cabin Cruiser Speed Boat No. 5 makes it a model of outstanding merit. It will travel over 500 feet on one winding. Finished in three different colour combinations—Red and Cream, Blue and White, and Jade Green and Ivory.
Dimensions : Length, 16½ in. Beam, 3½ in.

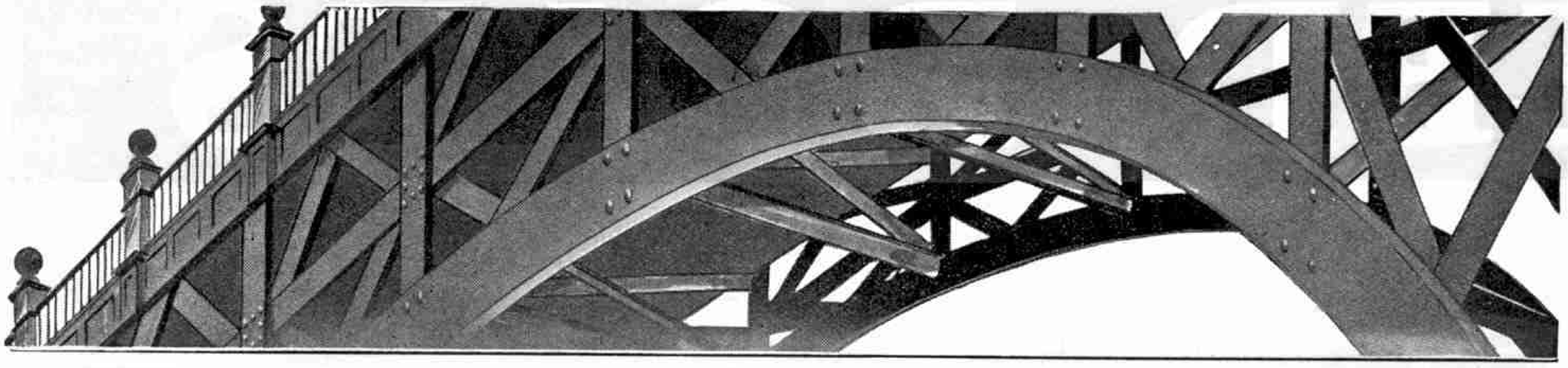
PRICE 16/6



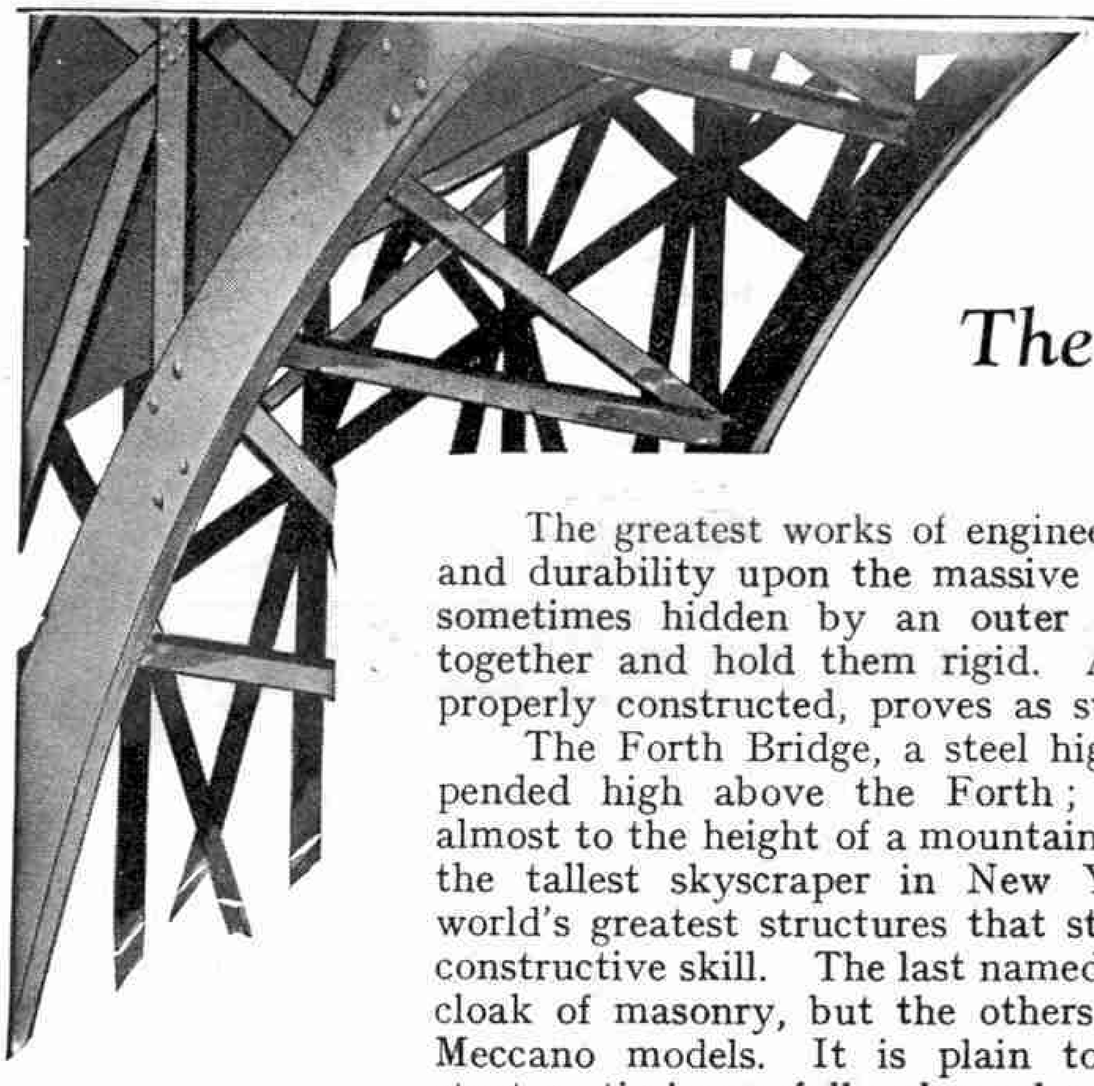
JOIN THE HORNBY SPEED BOAT CLUB

This is an illustration of the Hornby Speed Boat Club Badge. You may purchase one of these badges from your dealer, price 6d., or direct from us price 6d. post free.

HORNBY SPEED BOAT CLUB



MECCANO PARTS & ACCESSORIES



No. 1.—*Girders*

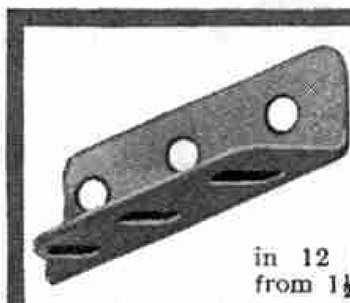
Their Importance in Engineering

The greatest works of engineering depend for their strength and durability upon the massive girders of steel which, though sometimes hidden by an outer casing of masonry, bind them together and hold them rigid. A single rolled steel girder, if properly constructed, proves as strong as a wall of masonry.

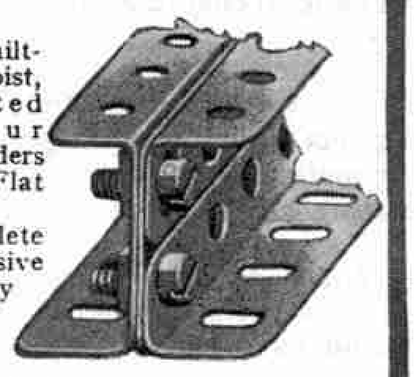
The Forth Bridge, a steel highway 1½ miles in length, suspended high above the Forth; the Eiffel Tower, extending almost to the height of a mountain; the Empire State Building, the tallest skyscraper in New York—these are three of the world's greatest structures that stand like monuments to man's constructive skill. The last named disguises its steel skeleton in a cloak of masonry, but the others tower into the sky like huge Meccano models. It is plain to see how even the smallest strut or tie is carefully planned and placed into position so that it may bear its allotted portion of strain or thrust.

Meccano Girders fulfil the same important duty in Meccano engineering. They are fitted into models and braced by Strips or Rods until the finished structure will support a man's weight, without the slightest disruption. Meccano Girders are made of the finest steel, and are beautifully enamelled in green. The edges and corners are rounded and smoothed off, while the perfect accuracy of their manufacture makes them invaluable in the construction of even the most intricate mechanisms. The following is a complete list of Meccano Girders and also of the different Meccano Strips, which may be used to form built-up girders.

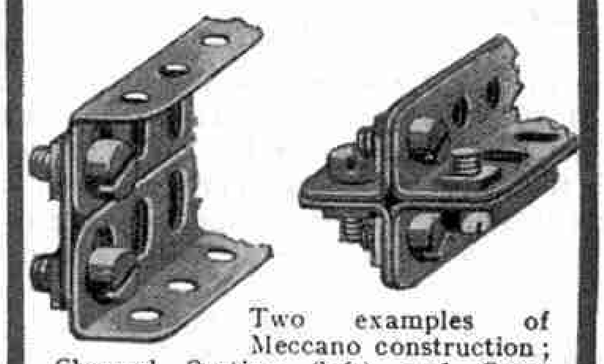
No.			s.	d.
Perforated Strips.				
1.	12½″	... ½ doz.	1	0
1a.	9½″	... „	0	9
1b.	7½″	... „	0	8
2.	5½″	... „	0	6
2a.	4½″	... „	0	5
Angle Girders.				
7.	24½″	... each	0	8
7a.	18½″	... „	0	6
8.	12½″	... ½ doz.	1	9
8a.	9½″	... „	1	3
8b.	7½″	... „	1	2
9.	5½″	... „	1	0
Double Angle Strips.				
46.	2½″ × 1″	½ doz.	0	6
47.	2½″ × 1½″	„	0	9
47a.	3″ × 1½″	„	0	10
48.	1½″ × ½″	„	0	4
55.	Perforated Strips, slotted, 5½″	... each	0	2
55a.	„ „ „ 2″	... „	0	1
89.	5½″ Curved Strips, 10″ radius	... „	0	2
89a.	3″ Curved Strips, cranked, 1¾″ radius, 4 to circle	each	0	2
89b.	4″ „ „ cranked, 4½″ radius, 8 to circle	„	0	2
90.	2½″ „ „ 2⅜″ radius	... „	0	1
90a.	2½″ „ „ cranked, 1⅜″ radius, 4 to circle	„	0	1
Braced Girders.				
97.	3½″ long	½ doz.	0	9
97a.	3″ „	„	0	8
98.	2½″ „	„	0	8
99.	12½″ „	„	2	6
99a.	9½″ long	½ doz.	2	0
99b.	7½″ „	„	2	0
100.	5½″ „	„	1	0
100a.	4½″ „	„	0	10
Flat Girders.				
103.	5½″ long	½ doz.	0	10
103a.	9½″ „	„	1	2
103b.	12½″ „	„	1	3
103c.	4½″ „	„	0	9
103d.	3½″ „	„	0	7
103e.	3″ long	½ doz.	0	6
103f.	2½″ „	„	0	5
103g.	2″ „	„	0	4
103h.	1½″ „	„	0	4
103k.	7½″ „	„	1	0
113.	Girder Frames	... ...	each	0	3
143.	Circular Girders, 5½″ diam.	... „	1	0
145.	Strips, 7½″ diam. over all	„	0	9



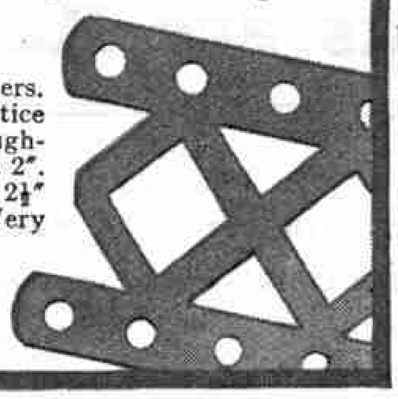
Angle Girders ("L" section, ½″ × ½″) in 12 lengths, ranging from 1½″ to 24½″.



Meccano built-up Steel Joist, constructed from four Angle Girders and one Flat Girder The complete unit is massive and of very great strength.

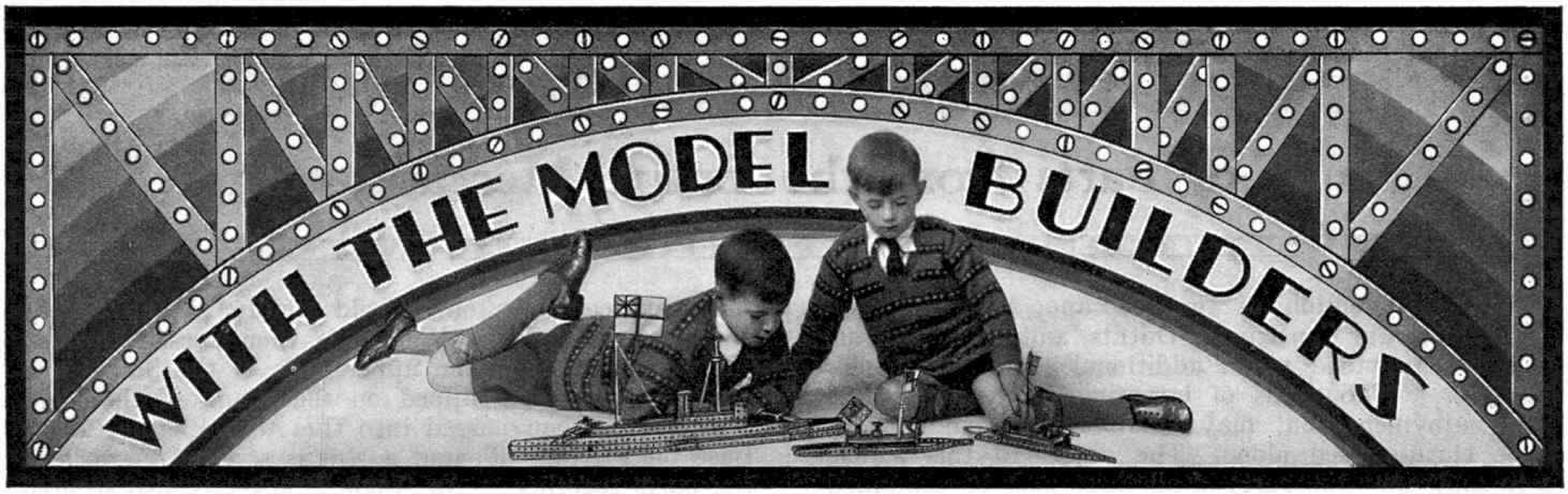


Two examples of Meccano construction; Channel Section (left) and Cross Section Girders. The latter consists of a pair of "T" girders butted together.



Braced Girders. Stout lattice work throughout. Width 2″. In 8 lengths, 2½″ to 12½″. Very ornamental and of great utility.

YOUR DEALER WILL BE PLEASED TO SHOW YOU ALL THE MECCANO PARTS. ASK HIM FOR A COMPLETE PRICE LIST.



TURNTABLES

In actual engineering many different types of turntables are employed. Perhaps the best known is the type used for turning railway locomotives at engine depots, etc., but turntables are employed also in many other branches of engineering. For instance, swing bridges are mounted on huge roller race turntables, and many large cranes, including the hammerhead and block-setting types, incorporate roller races or turntables about which the boom swivels. In Meccano many different types of roller and ball race mechanisms may be built up, and it is thus possible to construct a turntable or swivel race for models of different types and sizes.

An interesting illustration of the turntable mechanism is incorporated in the model searchlight illustrated on this page. This model is built to a comparatively small scale, and in consequence the turntable on which the searchlight standard is mounted must also be small. A neat and efficient unit has been formed by using a 4" Circular Plate (No. 146a) and a 5½" Circular Girder (No. 143), the rollers being formed from ¾" Flanged Wheels mounted round the inside rim of the Circular Girder. The flanges of the Wheels project above the top of the Girder and enable the 4" Circular Plate to swivel round on the Wheels when the hand rotating gear placed at the right-hand end of the model is actuated.

If a large model of a swing bridge or crane is to be built, a larger and stronger turntable must be used in order to allow for the heavy mass that has to be rotated, and for models of this type the Meccano Roller Bearing unit No. 167 should be employed. This unit is 11½" in diameter, and is provided with a roller cage carrying 16 Flanged Wheels. The heavy race of the crane boom or bridge superstructure is thus distributed over the Flanged Wheel rollers and a strong and smooth-running turntable results. A further advantage of this bearing is that the top and bottom races have teeth cut in their rims and, by meshing the special Pinion (No. 167c) with these teeth, a positive drive is produced for the superstructure.

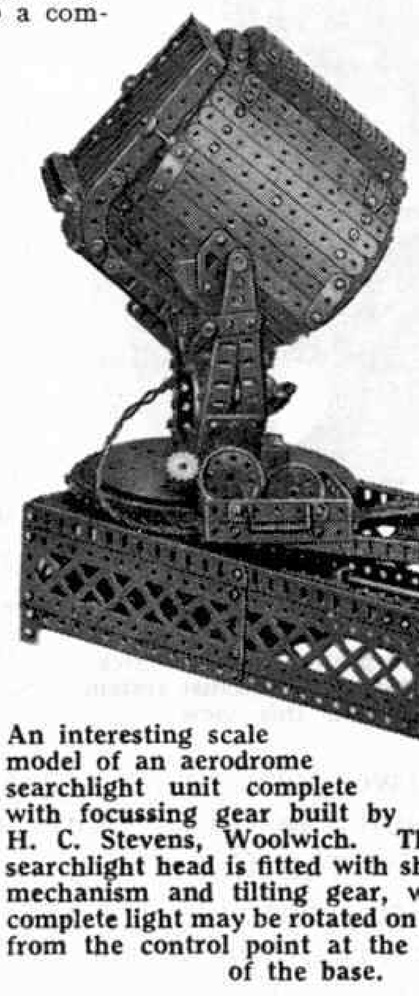
A turntable making use of steel balls is not employed to any great extent in engineering, this type of bearing being most generally used for journalling horizontal shafts. A bearing unit using steel balls mounted in a swivel cage is very efficient, however, as it enables smooth and steady rotary motion to be obtained. Meccano boys can build up a ball bearing unit of this type for themselves by using the 3" Pulley Wheels, a Wheel Flange and a number of Meccano Steel Balls. An even better result will be obtained by using the 4" Ball Bearing unit, part No. 168. This unit consists of two special Flanged Races one of which is provided with sprocket teeth so that it may be driven. A ball cage complete with balls fits between the two races and enables a smooth ball-bearing action to be obtained between the two parts.

AIDS TO MODEL-BUILDING

The assembly of any standard Meccano model is a simple matter, and no constructor should have any difficulty in using the Screwdriver and Spanners to screw the Meccano Nuts tightly on the shanks of the Bolts, so that the various Strips, Plates, etc., may be locked together in the required positions. As model-builders become more experienced in the assembly of mechanisms they are naturally keen to build more elaborate models entailing intricate assembly work, and the task of screwing up the nuts in the bolts is then not quite so simple. Two very useful aids to assembly work are the Special Screwdriver (No. 36B) and the Box Spanner (No. 34B). The Special Screwdriver is fitted with a blade of Meccano Axle diameter so that the Screwdriver may be passed through the holes in Plates, Strips, etc., and thus reach bolts inside a framework that could not be manipulated with the standard Screwdriver, which has a wide blade. The Box Spanner (No. 34B) is designed so that the Nut can be held in place in awkward corners while the bolt is being screwed up.

Another very useful tool is the Drift (Motor Car part No. A1083). This has recently been added to the range of Meccano Motor Car Constructor parts, but it will be found a very handy implement in assembling either Motor Cars, Aeroplanes or standard Meccano models. The Drift enables holes in Plates, Strips, etc., to be brought into alignment so that a bolt may be passed through. To manipulate the Drift for this purpose, the pointed end is inserted into the holes and pressed forward with a slight side-to-side motion. The effect of this is to pull the holes into alignment so that a bolt may be inserted easily.

It sometimes happens that there is insufficient room for a Spanner to be placed in position inside a model, and thus it is difficult to get the Nut "started" on the projecting shank of the Bolt; here again the Drift will be found useful. The Nut that is to be fitted in the model is placed on the tapered end of the Drift. The Drift, complete with nut, is then lowered into the interior of the model or mechanism and moved into position so that its pointed end touches the end of the shank of the Bolt, which is held in position by pressing the screwdriver against the slot in the head of the Bolt. The nut is now allowed to slide down the tapered end of the Drift until it reaches the end of the Bolt shank. A few turns are now given to the Bolt by means of the Screwdriver and this will enable the threads to grip the Nut. After this the Drift may be removed and the Nut screwed up tightly against the inside surface of the Plate or Strip.



An interesting scale model of an aerodrome searchlight unit complete with focussing gear built by H. C. Stevens, Woolwich. The searchlight head is fitted with shutter mechanism and tilting gear, while the complete light may be rotated on its turntable from the control point at the right-hand end of the base.

FLYWHEEL CONSTRUCTION

We are constantly receiving queries regarding the assembly of flywheels in Meccano, and a few notes on this interesting subject will doubtless prove useful to constructors. Model-builders will know that a Flywheel is already included as a standard part (No. 132) in the Meccano range. This Wheel is 2¾" in diameter, and while it serves its purpose excellently it is not suitable for models built to a large scale. Standard parts can be used however for building up Flywheels for large models.

A splendid built-up Flywheel may be assembled by securing a number of 7½" Circular Strips (No. 145) together. The larger the number of Circular Strips used, the greater will be the mass of the wheel rim, and the bigger the momentum imparted; but six Strips will give quite a good "flywheel" effect. A still larger Flywheel may be built up from Channel Segments (No. 119) supported on a system of spokes composed of Strips. This wheel is most suitable for use in very large models of stationary steam engines, pumping plants and similar mechanisms. The advantage of the wheel lies chiefly in its large diameter, and as the Channel Segments are hollow and therefore quite light, the wheel cannot be expected to provide a marked steadying effect on a mechanism to which it is connected.

In building models of petrol engines flywheels are also required, and it is possible to assemble a particularly neat wheel, such as is used in two-stroke petrol engines and light outboard motors, from a number of Flanged Ball Race discs (No. 168a), a 3" Face Plate, and a Wheel Flange. For a flywheel of medium depth, six Flanged discs will be required. The Wheel Flange and Face Plate are placed on the top disc and two ⅜" bolts are passed through from below to hold these parts in alignment. An Axle Rod is then secured in the boss of the Face Plate and the remaining five discs are slipped on to the Axle. A Bush Wheel is bolted to the lowest disc so that the complete unit may be clamped on the Rod. This assembly results in a compact yet heavy wheel that will be found very useful in various types of mechanism, in addition to model motor engines.

FREE WHEELS

Now that free wheels are being fitted between the gear box and rear drive of many actual cars, model-builders will be keen to incorporate a miniature version of the car type free wheel mechanism in their own Meccano chassis. The simplest pattern of free wheel makes use of a ratchet and spring-loaded pawl and this mechanism can be reproduced very easily with a Meccano Ratchet Wheel No. 148 and a Pawl No. 147, the Pawl being mounted on a Pivot Bolt No. 147B and held in contact with the teeth of the Ratchet by means of a short tension spring composed of Spring Cord. For smoother running, use two Pawls.

A compact car type free wheel unit can be built up from a 1⅛" Flanged Wheel, a Coupling, two Collars and two Threaded Pins. The Coupling is mounted on a Rod and the smooth shanks of the Threaded Pins are inserted in its end transverse bores. The 1⅛" Flanged Wheel is secured to a second shaft so that the flanged portion fits over the Coupling carrying the Threaded Pins. The Collars are inserted in the spaces between the flange of the Wheel and the Coupling. When running in a forward direction, the Flanged Wheel and the Coupling are quite free, but when one Shaft is reversed, the Collars immediately jam between the flange and the Coupling.

RETRACTABLE UNDERCARRIAGE.

Your suggestion that a retractable undercarriage unit should be added to the range of Meccano Aero parts is particularly interesting. The retractable or 'disappearing' undercarriage is one of the most recent developments in aeroplane construction, for only the very latest machines such as the Air speed 'Courier' and the Lockheed 'Orion' incorporate this feature. In a normal land machine, the undercarriage and landing wheels project from the bottom of the fuselage, and add considerably to the 'drag' or resistance to motion through the air of the machine. A retractable undercarriage, however, is arranged so that the landing wheels and the accompanying struts may be drawn up into the fuselage when the aeroplane is in flight, so that they are not in the air stream and consequently do not affect the performance of the aeroplane. In some machines the retracting mechanism is composed of a system of cables while in other designs, hydraulic means are employed for raising and lowering the undercarriage.

A miniature retractable undercarriage would form a very interesting addition to the Aeroplane Outfits, but the production of this mechanism to a scale suitable for the models would be a very intricate and expensive undertaking. However, a mechanism of this type is ideal for reproduction with standard Meccano parts, and we suggest that you build up a demonstration model of a retractable undercarriage in this manner. *(Reply to J. R. Tibbet, Hove.*

A Unique Motor Cycle

Built of Parts from the Entire Meccano Range

THE introduction of the Meccano Aeroplane and Motor Car Constructor Outfits, and the X Outfits, has provided much additional scope for model-building. Thousands of boys have experienced the keen enjoyment that may be obtained from each of these Outfits used alone. The object of this article is to show how the parts of all three may be combined with standard Meccano parts to produce results of remarkable realism.

The model chosen to illustrate the possibilities of this combination is a single-cylinder motor cycle, three views of which are reproduced. This model might well be called an "Aero-Motor-X" machine, as it incorporates parts from the Aero, Motor and X Outfits, in addition to standard Meccano parts. The neat and realistic result has been attained by adapting the various parts to uses outside their normal functions. For instance, the petrol tank of the model is an Aero Engine Casing unit formed from Aero parts Nos. P40 and P41; and the cylinder is composed of $\frac{3}{4}$" Discs from the X range and Meccano Washers.

The building of this unique motor cycle is particularly fascinating, and as many readers no doubt will wish to assemble it we give below details of its construction.

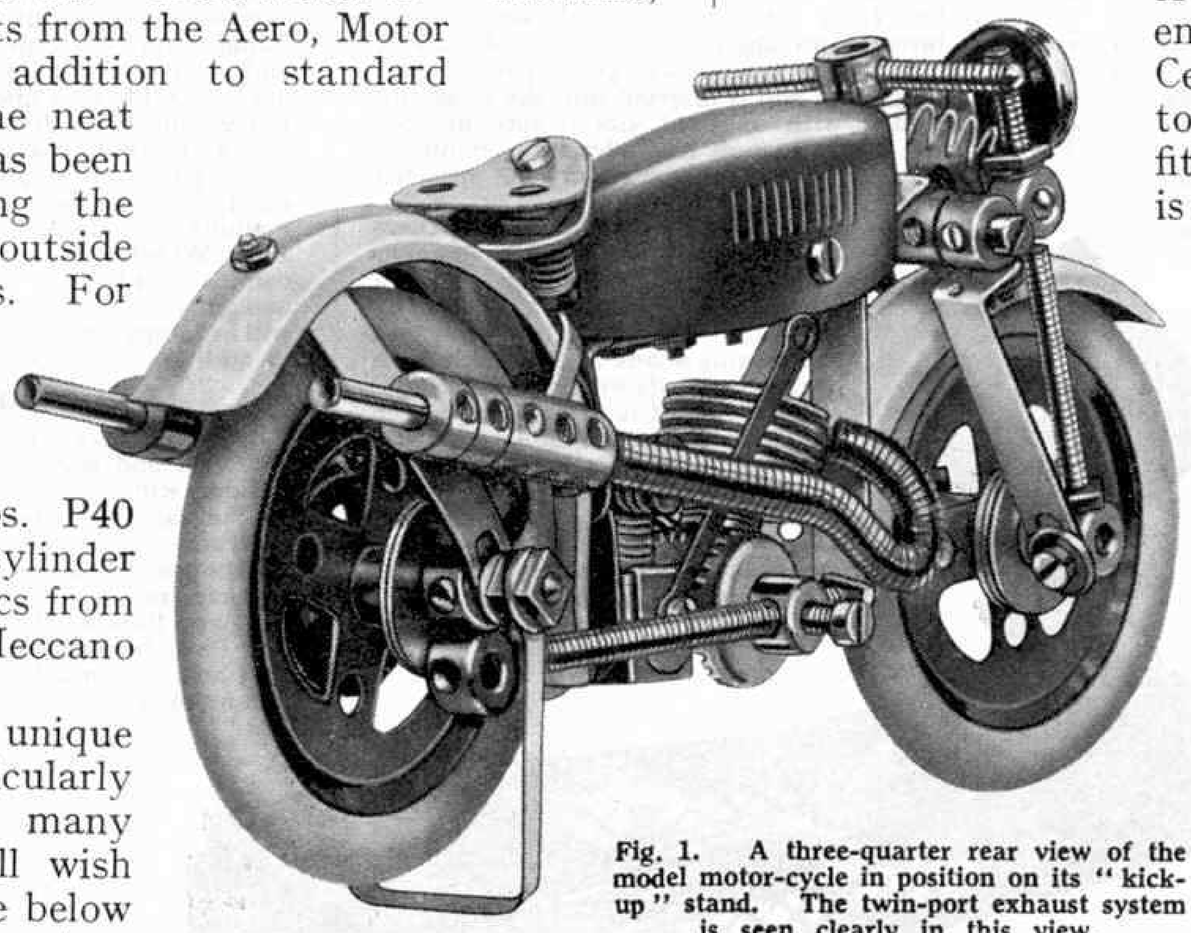


Fig. 1. A three-quarter rear view of the model motor-cycle in position on its "kick-up" stand. The twin-port exhaust system is seen clearly in this view.

The assembly of the model should be commenced by threading one end of a 1" Screwed Rod into the Set Screw hole of a "spider" (removed from a Swivel Bearing), and afterwards placing a nut on the Rod so as to lock the spider in position. Two $\frac{3}{4}$" Bolts are now taken and a $\frac{3}{4}$" Contrate Wheel is placed on each. The ends of the $\frac{3}{4}$" Bolts are threaded into opposite set-screw holes in the spider so that the part is held to the Contrates. The cylinder is built up by first slipping three Washers on to the Screwed Rod and following these with a $\frac{3}{4}$" Disc (part No. X477). A Washer is then placed in position for spacing purposes followed by another $\frac{3}{4}$" Disc. Discs and Washers are placed on the Screwed Rod until there are seven discs in position, and then a nut is screwed on to the projecting end of the Rod.

Part of the frame is now assembled around the cylinder and crank-case unit. The forward portion consists of two Aero Float Struts (part No. P30). A $\frac{1}{2}$" Bolt is first passed through the round hole of each Strut and a Nut is screwed on to the shank of each Bolt. The Bolts are then screwed into the Set Screw holes in the bosses of the Contrate Wheels and the Nuts on the shanks of the Bolts are tightened so that the crank-case portion is held rigidly to the Struts. A Bolt fitted with a Washer is then passed through the slotted holes in the upper ends of the Struts and a Flat Bracket is slipped on the shank of the Bolt. The Bolt is then passed into the Aero Engine Casing Base piece (No. P40) and a Nut is screwed on to lock the parts together. An Angle Bracket is also secured to the Engine Casing Base, and this Bracket, together with the Flat Bracket mentioned previously, form the pivot bearings for the front forks.

Each arm of the forks is composed of a $2\frac{1}{2}$" Screwed Rod (X435) and an Aero Centre Section Strut (P29). A spider is mounted on the lower end of the Screwed Rod, and the Centre Section Strut is attached to this by means of a Set Screw fitted with Washers. The spider is locked in position on the Screwed Rod by means of a Nut. A second spider is mounted near the upper end of the Screwed Rod, and a third spider is secured to it by means of a Grub Screw. The Grub Screw is driven partly into the Set Screw bore of one spider and the other spider is then screwed on to the projecting portion of the Grub Screw until the two parts lock together. The angled portion of the Centre Section Strut is held to the third spider by means of a Set Screw fitted with a Washer.

A Coupling is used to join the two fork arms together, two Bolts being passed through the centre bores of the spiders into the centre bore of the Coupling, where they are locked in place by Grub Screws. A 1" Rod is mounted in the centre transverse bore of the Coupling, and this passes through the Angle Bracket and Flat Bracket secured to the frame thus forming the pivot for the forks. A Collar fitted with two 1" Screwed Rods is mounted on the top end of the Rod thus forming the handle bar assembly. Before placing the Collar in position, two Compression Springs (No. 120b) should be slipped on to the Rod and also anchored to the $2\frac{1}{2}$" Screwed Rods.

The Motor Constructor Head Lamp is attached to a Flat Bracket mounted on a $\frac{3}{8}$" Bolt. This Bolt is screwed into the Coupling connecting the forks together, and the Bolt also carries an Angle Bracket to which the Front Mudguard is attached. A 5/32" 6BA Motor Car Bolt (No. A1076) and Nut (A1077) are used to hold the Front Mudguard (No. A1020) in place.

The rear portion of the frame consists of two $2\frac{1}{2}$" Screwed Rods that are passed into the Set Screw holes in the bosses of the Contrate Wheels. A spider is fitted to the rear end of each Rod and a Collar is secured to each spider by means of Grub Screws as described

previously. A 1½″ Strip is secured to the Engine Casing Base piece by means of two 5/32″ 6BA Bolts and a Flat Bracket is attached to the 1½″ Strip by a further 6BA Bolt. An Angle Bracket is now bolted to the Flat Bracket, a 6BA Bolt again being used. This Angle Bracket must be bent slightly so as to follow the contour of the Rear Mudguard. Before fitting the Mudguard in place, the gear-box and magneto unit should be assembled. The gear-box consists of three Double Brackets held together by means of 6BA Motor Car Bolts and Nuts. A ¾″ Disc (No. X477) is secured to the left-hand side of the box to represent the secondary chain sprocket cover.

The magneto is represented by a Threaded Boss. Four Washers are secured to one end of the part by means of a ⅜″ Bolt and the complete magneto is mounted on a stand consisting of five Washers placed on a ½″ Bolt passed through the top of the gear-box. A Flat Bracket is secured to the rear of the gear-box by means of a 6BA Bolt and a second Flat Bracket is attached to this. The gear lever, a Tie Rod (No. A1027), is attached to the right-hand side of the box by means of a 6BA Bolt and Nut.

The Aero Engine Casing Top piece is next mounted in position and secured by means of a Stub Axle Pivot (A1071). The gear-box and magneto unit are now placed in position between the frame. The Rear Mudguard (A1022) is first mounted in place together with a Lower Front Mudguard Bracket (A1025), which acts as a support for the saddle, and a ¼″ 6BA Motor Car Bolt (A1082) is passed through the Mudguard, Flat Bracket, Mudguard Bracket and also through the Angle Bracket forming part of the frame, all these parts being secured together finally by means of a 6BA Nut.

The rear fork stays consist of an Aero Float Tie Rod (No. P57) bent into the shape of a " U," which is passed round the Mudguard just below the saddle.

The saddle is composed of three 1″ Triangular Plates held together by a 5/32″ Bolt, which also passes through the Mudguard Bracket that supports the saddle. Two ⅜″ Bolts fitted with Compression Springs are attached to the rear holes of the Plates to represent saddle springs. The rear wheel axle is a 2″ Screwed Rod, and on this the 2″ Pulley forming the rear wheel, the brake drum, " kick-up " stand and exhaust pipe brackets are mounted. Two mudguard stays are formed from Aero Centre Section Struts bolted to the Mudguard by a ¼″ 6BA Bolt. The slotted ends of the Struts are locked to the Screwed Rod forming the rear axle against the Collar supports. The brake drum is represented by two ¾″ Discs placed at the right-hand side, while a 1″ Loose Pulley mounted at the left does duty for the rear wheel sprocket. The supports for the dual exhaust system consist of Flat Brackets fitted with ⅜″ Bolts that pass into the Couplings forming the expansion chambers of the exhaust system. The kick-up stand is made from an Aero Float Tie Rod bent to form a flattened " U " piece. The perforated ends of the Tie Rod are slipped over the projecting ends of the 2″ Screwed Rod, and a Washer and Nut are screwed on so that the stand may be moved in either horizontal or vertical positions.

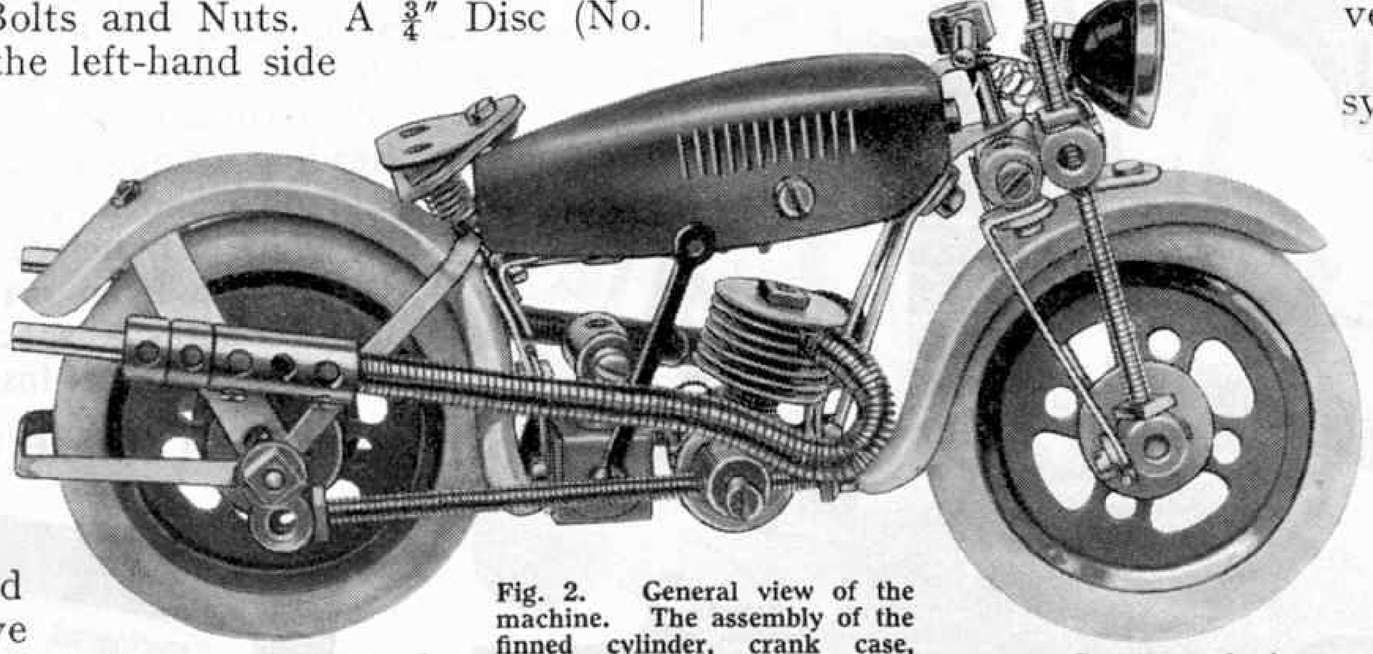


Fig. 2. General view of the machine. The assembly of the finned cylinder, crank case, gear-box, and other fitting smay be followed from this illustration.

The two-port exhaust system is made up from Axle Rods and Tension Springs (No. 43), while Couplings and Collars are used to represent the expansion chambers. A 2½″ Axle Rod is mounted in each Coupling and two Tension Springs are slipped over the Rod, the looped end of one Spring being wedged in between the " fins " of the cylinder. These Springs are anchored to the frame at the forward end by means of small pieces of Copper Wire. A 1½″ Axle Rod is secured in the rear end of the Coupling and two Collars are mounted on this Rod so as to extend the " expansion chamber."

The front road wheel axle is a 1″ Rod secured in the spider on the ends of the forks. Four ¾″ Discs are mounted on the right-hand side of the 2″ Pulley to represent the brake drum, this being spaced by means of five Washers.

Finally we come to the tyres. Owing to the lack of a tyre of suitable motor cycle section for the 2″ Pulley, it is necessary to reduce a 3″ diameter Rubber Ring so that it will fit to the rim of the 2″ Pulley. This is done by cutting out a small section of the Ring with a penknife and joining the ends together with clips made from pins, two clips being required for each Ring. The head of the pin is removed and the remaining portion is bent into a " U." The ends of the " U " are pressed into the adjoining portions of the Rubber Ring so as to hold them securely in place.

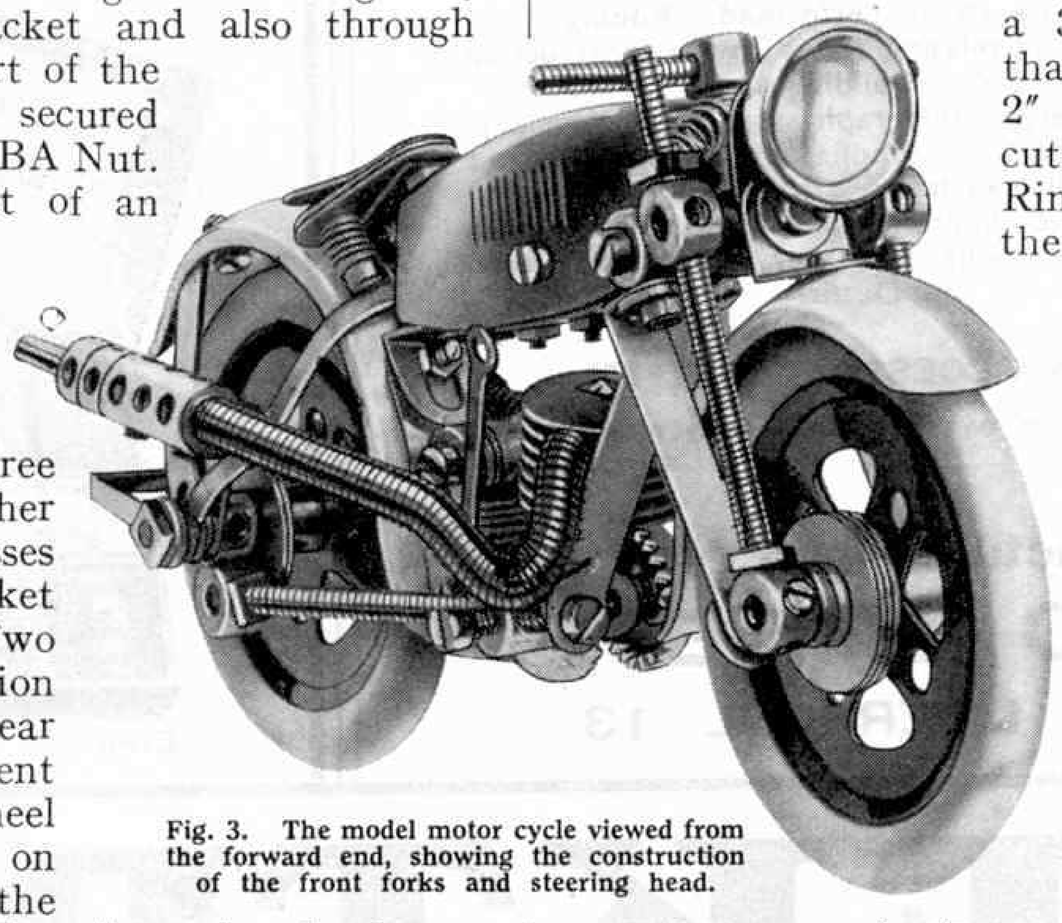


Fig. 3. The model motor cycle viewed from the forward end, showing the construction of the front forks and steering head.

A New Competition

The model motor cycle just described represents only one instance of what can be done by combining the various parts in the Meccano range. In order to encourage originality in this type of model-building, we have decided to award prizes of £1/1/–, 15/– and 7/6 respectively for the three best models sent in by competitors living in the British Isles, and a separate and similar set of prizes for the three best models sent in by competitors living Overseas.

(*Continued on page 474*)

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ELECTRICAL OUTFITS

Outdoor Meccano Model-Building

Prizes for Models in Realistic Surroundings

WITH the coming of summer and the counter-attractions of cycling, cricket and other open-air sports and pastimes, indoor games and hobbies lose much of their interest for the majority of boys. It is only natural, therefore, that Meccano model-building passes a little into the background, to be resumed with renewed enthusiasm when the dark winter evenings come again. Many boys do not wish to suspend their Meccano activities altogether, however, provided that their model-building does not prevent them from taking advantage of the fine weather; and in order to meet the requirements of these enthusiasts we have decided to arrange a special competition in which all the necessary work can be done out in the open air.

In this Contest competitors are asked to submit photographs showing Meccano models incorporated in natural and realistic outdoor surroundings. Models need not be specially built for this Contest, any model that is available may be used for the purpose, provided that it has not previously won a prize in a Meccano Contest.

Three examples of Meccano models incorporated in realistic surroundings. The aeroplanes and aerodrome are the work of W. Vecchini, Ancona, Italy, and the motor scene is by A. K. Lewis, Capetown. The bridge and river scene was designed by C. Begeman, Semarang, Java.

Building models and incorporating them in realistic settings is a particularly fascinating pastime and, as the illustrations on this page show, very fine results can easily be obtained. The models illustrated are prizewinning entries from a similar contest held last year, and they indicate clearly the kind of entries that will win the prizes in the present Contest. Other suitable subjects would be a scene in a railway goods yard; a mechanical excavator at work in a miniature quarry; or a docks view showing a Meccano ship alongside a wharf fitted with cranes for discharging the cargo. These are only a few suggestions intended to set competitor's minds at work to devise ideas of their own. Any kind of model may be used, but in selecting subjects care should be taken to choose something that will be easy to incorporate in a suitable setting.

Competitors should not make the mistake of thinking that elaborate surroundings for their models are necessary. The main object is to make the setting as lifelike as possible, and this is often easier with a simple but boldly arranged design than with an elaborate setting crammed with a lot of unnecessary detail. It is the effect of the model and its surroundings as a whole that counts, not the nature of the details of which the setting is made up. The model itself may be quite a simple one, good proportions and a realistic outward appearance being the main features required.

In organising this Contest we realise that for large numbers of Overseas readers climatic conditions are exactly opposite to those existing in this country at the present time. In order to secure as far as possible equality for all readers, we have decided that Overseas competitors may regard this Contest as being for the best examples of Meccano models in realistic surroundings of any kind, either indoor or outdoor. This special condition which, it is important to note, applies to Overseas competitors only, allows models to be placed in suitable artificial settings indoors.

In order to enter this Contest it is necessary to send a photograph showing the model in its surroundings. Drawings cannot be accepted.

Photographs of unsuccessful entries will be returned to the senders provided that a stamped addressed envelope of the necessary size is enclosed with the entry. It should be noted, however, that photographs of prize-winning entries become the property of Meccano Limited. If the photographs submitted are suitable we shall reproduce some of the best prize-winning models in the "*M.M.*" when the Contest results are announced.

Entries will be divided into three sections:—Section A, for readers over 14 years of age living in the British Isles; Section B, for readers under 14 living in the British Isles, and C for Overseas readers.

Entries must bear the competitor's age, name and address and should be posted to Second "Realism" Contest, Meccano Ltd., Binns Road, Liverpool 13. The closing dates are:—Sections A and B, 31st July, 1933. Section C, 30th September, 1933.

Prizes Offered in this Contest

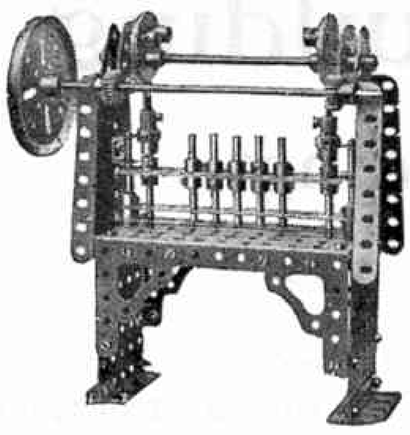
The Prizes to be awarded in each of the Sections A and C are as follows:—

First Prize:	Meccano or Hornby goods value	£3/3/0
Second Prize:	Meccano or Hornby goods value	£2/2/0
Third Prize:	Meccano or Hornby goods value	£1/1/0
	Six Prizes of goods value	10/6
	Six Prizes of goods value	5/-

The Prizes to be awarded in Section B are:—

First Prize:	Meccano or Hornby goods value	£2/2/0
Second Prize:	Meccano or Hornby goods value	£1/1/0
Third Prize:	Meccano or Hornby goods value	10/6
	Six Prizes of goods value	5/-
	Twelve "Meccano Engineer's Pocket Books"	

Prizewinners will be allowed to choose whatever goods they like from current Meccano and Hornby catalogues.



Suggestions Section

Edited by "Spanner"

(287)—Combination Safe Door Lock (G. Whalley, Ottawa, Ont., Canada)

The safe door shown in Fig. 287 is fitted with a combination lock that is absolutely fool-proof. Only one dial is necessary for obtaining the combination, and a second knob 2 is used for withdrawing the bolts. The handle 3 is provided for opening the door, but this in no way controls the mechanism of the lock. The construction of the safe door and frame is clear from the illustrations (see Figs. 287 and 287b). The door is made of four $5\frac{1}{2}'' \times 3\frac{1}{2}''$ Flat Plates and two $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Plates, secured to four $9\frac{1}{2}''$ Angle Girders. The frame is constructed from Angle Girders and Flat Girders, and the safe should be built round this. If insufficient parts are available for the complete safe, this may be made of sheet metal bolted to a framework of Angle Girders, or may even consist of a wooden box.

The door and frame need not be of the same size as shown, and should be built to suit individual requirements. The hinges are of the type that have previously been described in this section. The Collars 4 are fixed to the door and the Collars 5 to the frame. They are secured by bolts inserted in their tapped holes and spaced from the Angle Girders by Washers. Each bolt also carries a Washer beneath its head. A $2\frac{1}{2}''$ Rod is passed through the Collars and is firmly held by Grub Screws in the Collars 4, but is free to turn in the others.

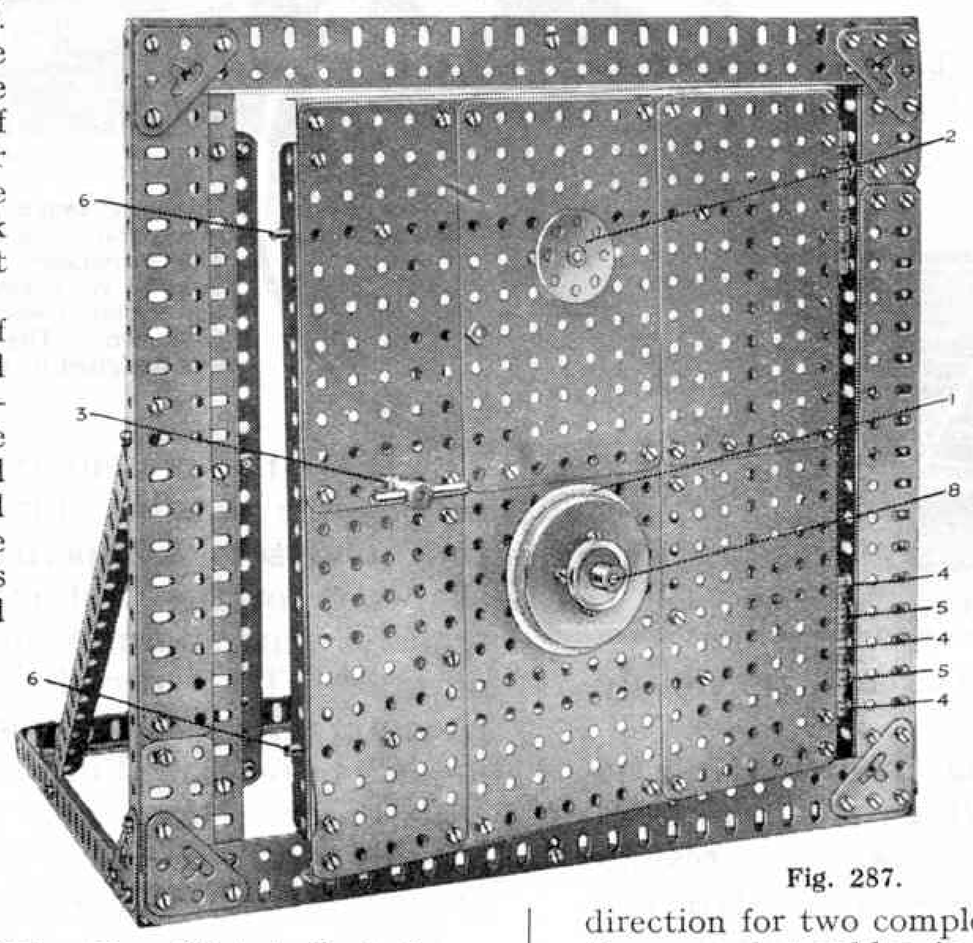


Fig. 287.

The bolts 6 can be seen projecting slightly in Fig. 287 and their arrangement is shown in Fig. 287b. Two 8″ Axle Rods form the bolts and are connected across their ends by a further 8″ Rod. The Rods 6 slide in Angle Brackets spaced from the door by Washers, and it is important that the Angle Brackets should be in line with the holes in the Angle Girders, so that the Rods slide freely. The Rod 7 is journalled in the boss of a Double Arm Crank and carries the Bush Wheel 2 (Fig. 287) and a $\frac{1}{2}''$ Pinion that engages with a Worm on the upper bolt.

The housing for the tumblers is made from two $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates and one $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plate. Two $3\frac{1}{2}''$ Angle Girders are bolted to the sides, and the structure is braced by $1\frac{1}{2}''$ Corner Brackets. The tumblers are shown removed in Fig. 287a. Each consists of a Face Plate loose on the Rod and carrying four $2\frac{1}{2}''$ Curved Strips fixed in place by Flat Brackets. A gap is left in each set of Strips as is shown in the illustration. The Bush Wheel 9 is fixed to the Rod and carries a Threaded Pin. Three Washers space the Bush Wheel from the first Face Plate and the remaining Plates are each spaced apart by one Collar and four Washers. A Collar placed behind the end Face Plate holds them all in position. Two of the Face Plates are provided with two Threaded Pins each placed as shown at 10 and 11, and the third Plate carries only one Threaded Pin 12. The Rod 8 passes through the safe door and carries a Face Plate 1 (Fig. 287) to which a piece of paper carrying the numbers is glued. A Wheel Flange is bolted to the Face Plate and a 1″ Pulley on the end of the Rod finishes off the knob.

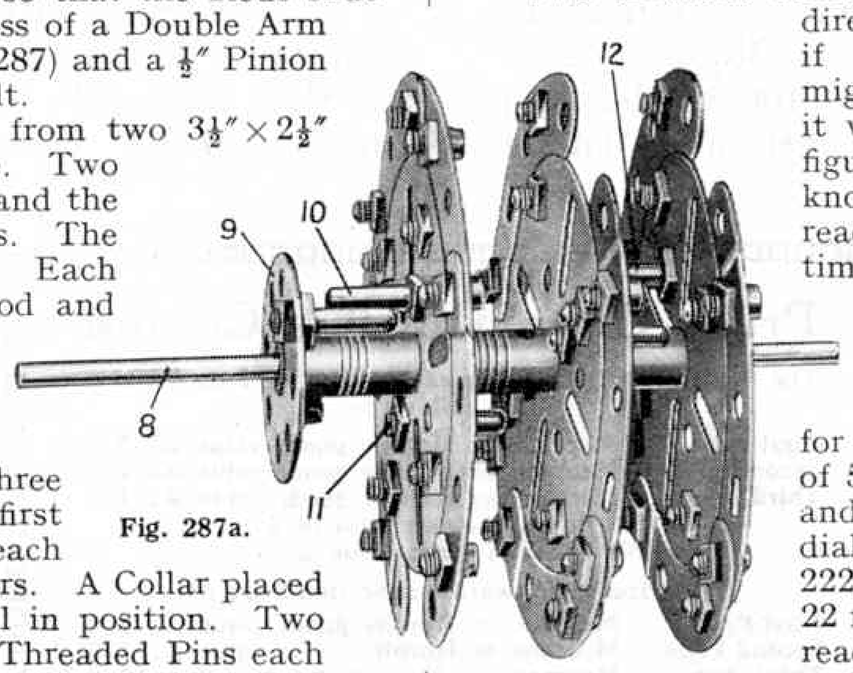


Fig. 287a.

The $4\frac{1}{2}''$ Rod 13 is fixed in a Double Arm Crank bolted to the safe door and carries a Boss Bell Crank that is loose on the Rod but retained in position by a Collar. Six $2\frac{1}{2}''$ Strips 14 are fixed between the arm of the Bell Crank and a Crank at the other end of the Rod, by means of $1'' \times 1''$ Angle Brackets. Two $2\frac{1}{2}''$ Strips 15 are bolted to the Bell Crank and carry a Threaded Boss. When the Strips 14 are in the raised position the Threaded Boss prevents the bolts from being withdrawn on account of the Rod 16. As soon as the tumblers are arranged with all the gaps in the Curved Strips in line immediately beneath the Strips 14, the latter drop into place and the Threaded Boss on the Strips 15 no longer prevents the bolts from being shot back. A 1″ Screwed Rod prevents the Strips 15 from moving back too far, so that by turning the dial again the Strips 14 are raised. Pendulum Connections are arranged to bear on each set of Curved Strips and serve as brakes to prevent the tumblers from rotating too freely.

To find the combination the following procedure should be adopted. Turn the dial until all the Threaded Pins on the Face Plates are engaged, and note the reading when the gap in the third tumbler takes up its correct position. The reading should be taken against a certain hole in one of the Plates, the omission of a pointer making it more difficult for the safe to be opened in the event of the would-be safe-breaker finding out the combination. Having obtained the first reading, turn the dial in the reverse direction for two complete turns, and then note the reading when the second tumbler is correctly placed. Now turn the dial in the original direction for one complete turn and continue turning slowly until all three tumblers are correctly arranged for the Strips 14 to drop.

Two different combinations may be taken, according to the direction of rotation of the dial. For instance, if turned clockwise first, the combination might be 3321515. By writing it this way it would be difficult for a person finding the figures to open the safe, but to the one who knows, they would mean that the first dial reading is 33 after turning the knob several times in a clockwise direction. It is then necessary to give two complete turns in the opposite direction and continue turning until a reading of 15 is obtained. Again reverse the direction of rotation for one complete turn, and the final reading of 5 is taken before the knob 2 can be turned and the safe opened. By first turning the dial anti-clockwise a combination such as 22222133 may be obtained. This means 22 first reading, two turns clockwise, 22 second reading, one turn anti-clockwise, and 33 third reading. From these figures it will be seen that the possibilities of the safe being opened by an uninitiated person are very remote.

A safe built on these lines can be put to many useful purposes. Meccano Clubs should find one useful for keeping articles of any value safe from unwanted intruders, and the lock may even be used for the Meccano cupboard.

(288)—An Original Quick Return Motion (V. Welsby, Whitchurch, Cardiff)

Quick return mechanisms are used extensively in machine tools for speeding up operations by increasing the speed of the return or idle stroke. They may also be employed for intermittent feed movements where a moving Pawl is used for rotating a Ratchet Wheel. In this case the arm carrying the Pawl would be speeded up on the return stroke so that the pause between each movement of the Ratchet would be decreased.

Mechanisms of this type that have previously been dealt with in this section are dependent upon sliding parts for their operation. With such arrangements a considerable amount of power is absorbed in overcoming the friction between the sliding surfaces, which must be kept constantly lubricated to ensure satisfactory working. This disadvantage is entirely overcome in the device illustrated in Fig. 288, which is operated by a crank and an ingenious system of pivoted connecting rods.

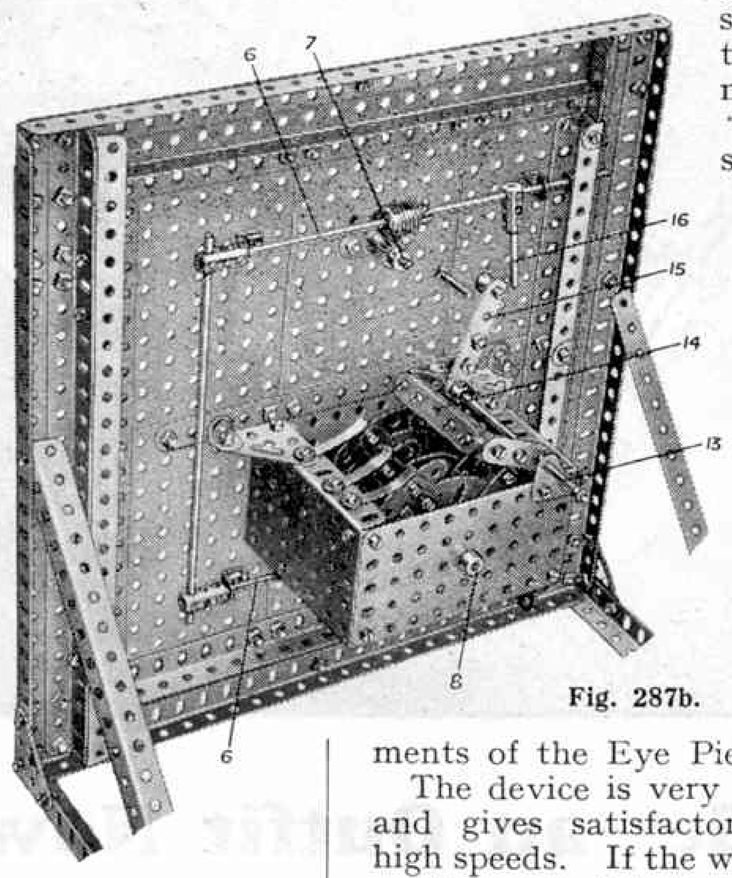


Fig. 287b.

The driving Crank 1 is pivoted to a 3½″ Strip that is pivoted at 2 to a further 3½″ Strip and a 3″ Strip, the latter being bolted to a Crank that is free to swing about a fixed pivot 4, consisting of a Pivot Bolt attached to the frame by two nuts. The second 3½″ Strip is connected to the part of the model requiring a quick return motion, and in Fig. 288 is shown pivoted at 3 to a sliding Eye Piece. This is not essential, however, and would be substituted by the work table in a planing machine model.

In the position shown the Crank 1 rotating anti-clockwise, is on the power stroke and the Eye Piece slides slowly over to the left. When the web of the Crank swings over towards the pivot 4, the Eye Piece returns more rapidly. The closer the Crank 1 is to the pivot 4, the more rapid will be the movements of the Eye Piece.

The device is very smooth in operation and gives satisfactory results at fairly high speeds. If the work table is arranged on slides, careful attention should be given to the alignment of these and they should be kept well oiled.

(289)—Two Speed Epicyclic Gear Box

(John R. Thorn, Winchester)

The type of epicyclic gear box reproduced in Fig. 289 has certain advantages over the more orthodox gear box, chief of which are the smoothness with which the drive can be taken up and the fact that all gears are in constant mesh.

The gear box illustrated is shown mounted between the side girders of a Meccano motor chassis. The driving shaft 1 carries two Face Plates, which are spaced apart about ½″ and carry two 2″ Axle Rods 3. These Rods each carry a ½″ and a ¾″ Pinion, and a 2½″ Strip 4 is fitted between the two Pinions, a washer being placed between the Strip and each ½″ Pinion. The Rods 3 are held in place by Collars and it is important that the Rods should rotate freely.

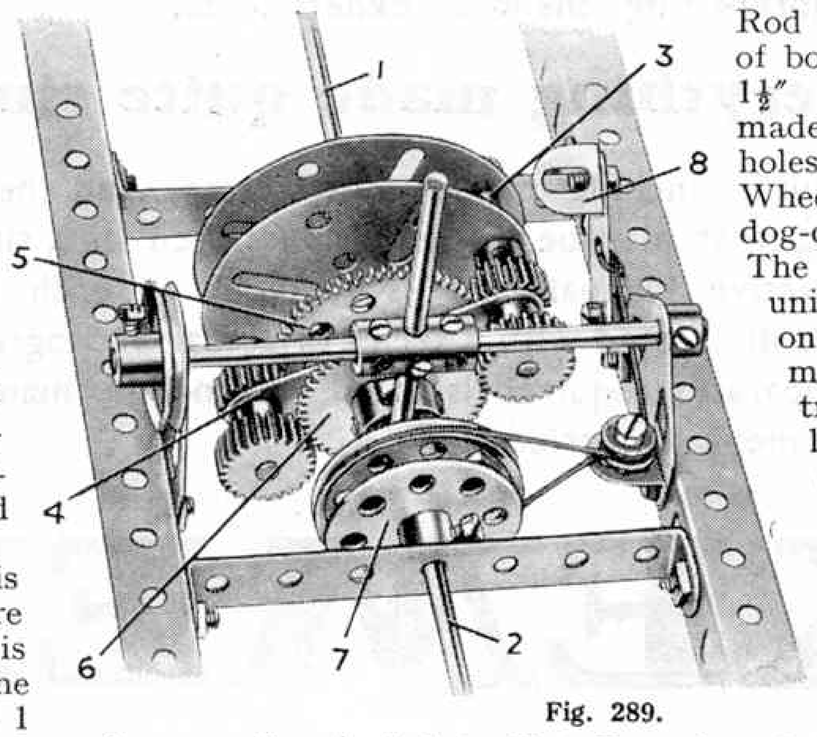


Fig. 289.

The driven shaft 2 is passed through the centre hole of the Strip 4 and is inserted in the boss of the Face Plate on the Rod 1 for a short distance to keep it correctly centred. A 57-teeth Gear 5, fixed on the Rod, is spaced from the Face Plate by a washer and from the Strip 4 by three washers. The 50-teeth Gear 6 is held in a Socket Coupling in which also a 1½″ Pulley is secured. The Socket Coupling unit is free on the Rod 2 and a Collar is placed between the Gear 6 and the 2½″ Strip. A length of Cord is tied to an Angle Bracket fixed to the frame and passed round the 1½″ Pulley and is then led round a ⅜″ Bolt which is fixed by two nuts to the Angle Bracket and carries two washers to keep the Cord in place. The Cord is finally tied to the foot pedal 8 consisting of a pivoted 1½″ Strip to which an Angle Bracket is bolted. A Bush Wheel 7 is fixed on the driven Rod and the shanks of bolts fitted to the 1½″ Pulley can be made to engage the holes in the Bush Wheel to form a dog-clutch.

The Socket Coupling unit is free to slide on its Rod and its movement is controlled by a hand lever consisting of a 2½″ Axle Rod. The lever is held in a Coupling carrying two 2″ Rods that are journalled in Flat Trunnions bolted to the side girders. To engage low gear the hand lever is pulled back, thus disengaging the dog-clutch, and the foot pedal is depressed to apply the brake to the 1½″ Pulley, which is held stationary. Top gear is engaged by releasing the foot pedal and moving the hand lever forward. This engages the dog-clutch and gives a "straight through" drive, as the two Gears 5 and 6 become solid on the driven Rod 2.

Miscellaneous Suggestions

Under this heading "Spanner" replies to readers who submit interesting suggestions regarding new Meccano models or movements that he is unable to deal with more fully elsewhere. On occasion he offers comments and technical criticisms that, he trusts, will be accepted in the same spirit of mutual help in which they are advanced.

(M.160.) Big-end Lubrication.—The lubrication of the working parts of a large model is of the utmost importance if maximum efficiency is to be obtained. Not only does proper oiling ensure smooth and silent running, but by decreasing the friction between moving surfaces it makes less power necessary to drive a model. Most bearings can be oiled while the model is operating, but for fast moving big-end bearings some other method must be devised. H. L. Timkin (Manchester) uses a Coupling for the big-end, the crank-pin passing through the end transverse hole. The corresponding tapped bore carries a Grease Cup (part No. 174) that keeps the bearing constantly lubricated. A thin semi-solid grease such as vaseline should be used, and the cap of the Grease Cup given a half turn occasionally when the model is stationary.

(M.161.) An Ingenious Belt Conveyor.—K. Villiers (Birmingham) submits an interesting suggestion concerning a conveyor belt. He points out that it is frequently difficult to obtain suitable material for making a belt of the required width and length, whereas with his method any width or length can easily be obtained by using standard Meccano parts. The drums or rollers carrying the belt consist of Sleeve Pieces fitted between ¾″ Flanged Wheels. Spring Cord is used for the conveyor belt, the required width being obtained by placing a number of lengths side by side. Each piece of Spring Cord should be exactly the same length, and the two ends connected by means of the special screws provided for this purpose.

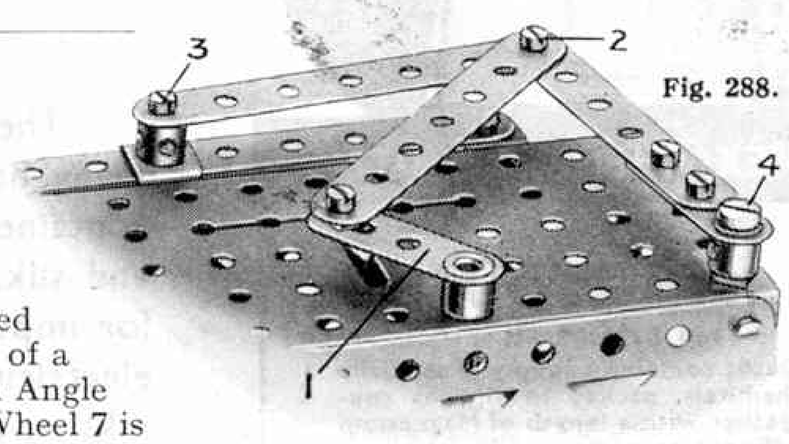


Fig. 288.

(M.162.) Transmission for Rotating Structures.—When a large structure is made to rotate, as in a model roundabout, the revolving part continues to move for a short time after the Motor has been switched off. This movement is likely to cause damage to the gearing if a Worm drive is employed, and to overcome the difficulty J. Winston (Plymouth) uses a free-wheel mechanism so that the revolving structure is free to continue turning after the driving shaft has stopped. The device consists of a Double Arm Crank carrying a 2½″ Strip and fitted on a vertical shaft immediately beneath the Rod carrying the revolving structure. At each end of the 2½″ Strip is fixed a Pivot Bolt carrying a Pawl, and these two Pawls are made to engage a Ratchet Wheel on a second Rod that is secured to the centre of the rotating structure.

If this method of drive is employed the model can move only in one direction, so that some other means must be devised for fitting in a model intended to turn in either direction. A friction clutch may be used for this purpose, and may consist of Pulleys with Tyres.

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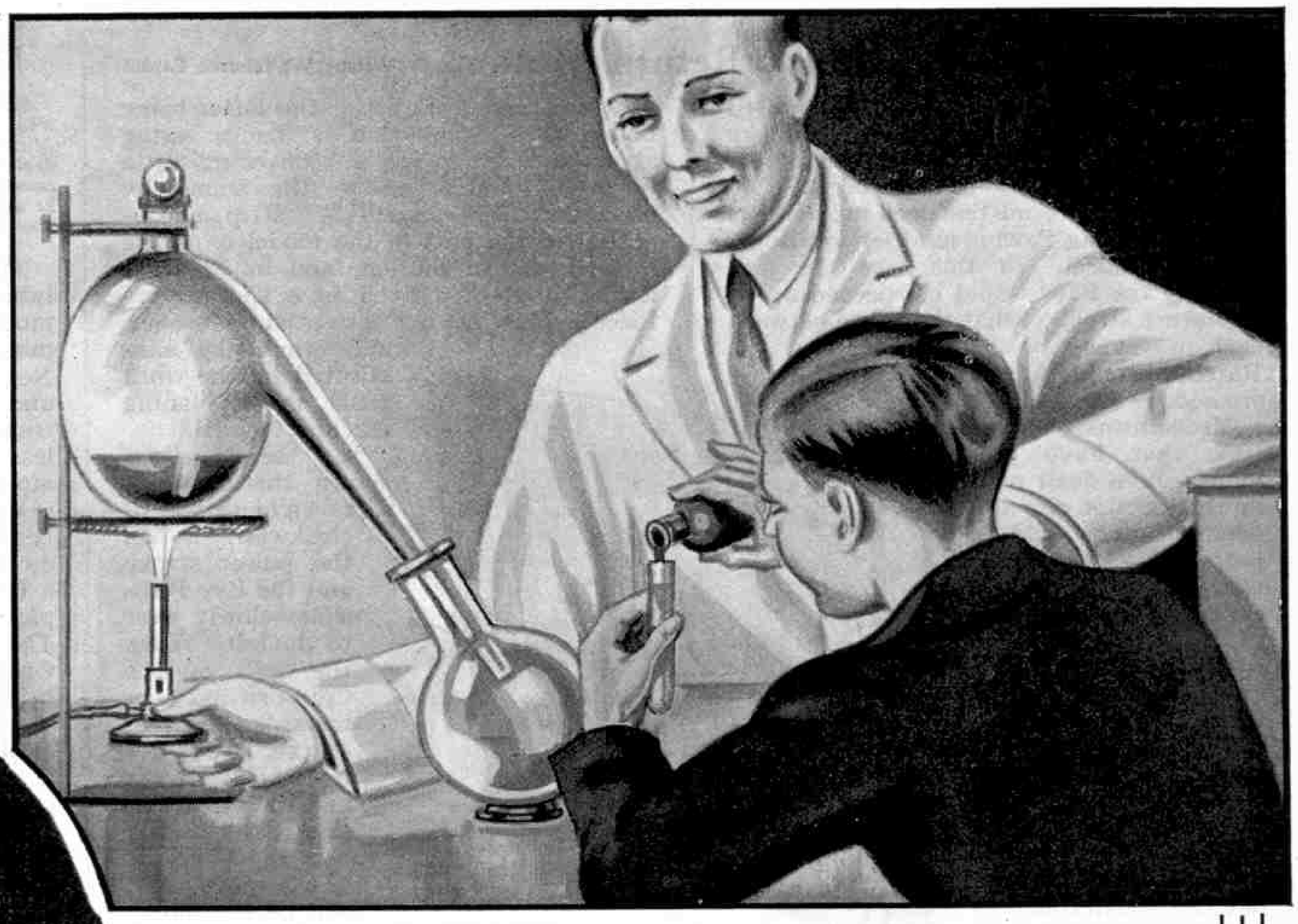

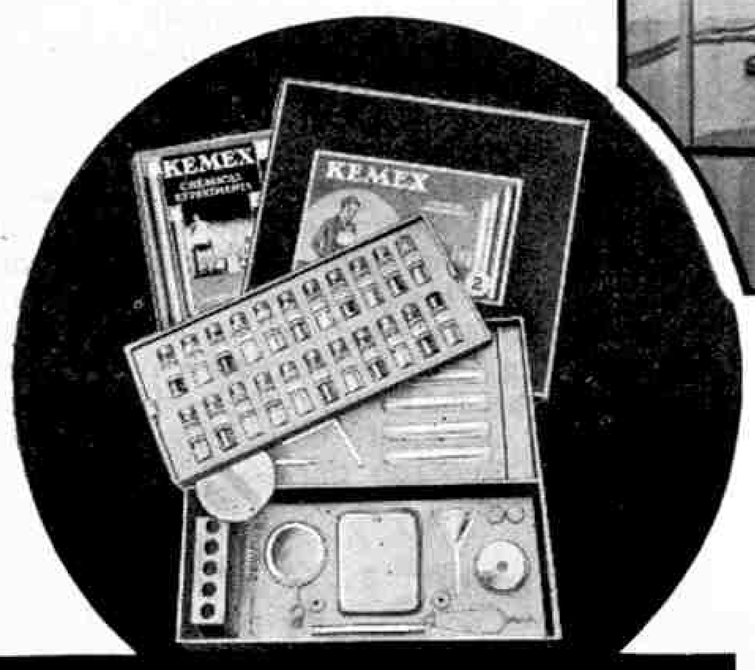

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Meccano Competition Results

By Frank Hornby

"Winter" Model-Building Contest (Overseas)

The full list of prizewinners in the "Winter" Model-Building Contest, details of which were published in the November, 1932, issue of the "*M.M.*," is as follows :—

First Prize, Cheque £3-3s. : E. Tait, Durban, S.A. Second Prize, Meccano or Hornby goods value £2-2s. : J. Gibbs, Wellington, N.Z. Third Prize, goods value £1-1s. : I. Rietti, Rheinfelden, Switzerland.

Six Prizes of goods value 10/6 : X. Rowlands, London, S.E.7 ; P. Kilpin, Capetown, S.A. ; L. Ison, Victoria, Australia ; J. Offringa, Batavia, Java ; L. Biesot, Utrecht, Holland ; A. Sevenich, Köln w./Rh, Germany.

Six Prizes of goods value 5/– : J. de Bruijn, Boskoop, Holland ; R. Wallace, Melbourne ; G. and R. H. Alington (joint entry), Invercargill, N.Z. ; L. de Bruin, Amsterdam ; A. Ness, Port Dalhousie, Ontario ; K. van Dommelen, Antwerp.

Six Prizes of "*Famous Trains*" : T. Brook, Natal, S.A. ; C. Blackbeard, Johannesburg ; T. Doyle, Victoria, Australia ; R. Maltha, Rotterdam ; T. Ralling, Capetown ; R. Harrington, Umtali, S. Rhodesia.

Prizes of Meccano "Engineer's Pocket Books" : J. Fry, Sydney, N.S.W. ; B. Hyde, Johannesburg ; M. Rankin, Melbourne ; C. Carter, Nixon, Ontario ; M. v. Brandwyk, Rotterdam ; C. Heyden, Hamburg ; J. Sonnen, Eindhoven, Holland ; W. Egginton, Melbourne ; E. Paasche, Bergen, Norway ; G. Austin, Auckland, N.Z. ; L. Hurtley, Kingston, Nova Scotia, Canada ; B. Zambianchi, Parma, Italy.

Two working models, one of which is a steam roller, and the other a reproduction of the L.M.S.R. "*Fury*" locomotive, won First Prize for E. J. Tait. The steam roller is a particularly fine model, and is driven by an Electric Motor bolted vertically in position at the rear end of the boiler. The drive is taken to a gear-box that has two forward speeds only, reverse motion being obtained directly from the Motor switch. In low gear the ratio between the motor armature shaft and the rear axle is 630 : 1, and in top gear 200 : 1. The road roller is made up from eight Wheel Flanges, between which are placed pieces of lead to give weight. Steering is carried out by the worm and pinion method as in the Meccano Super Model Traction Engine (Instruction Leaflet No. 22).

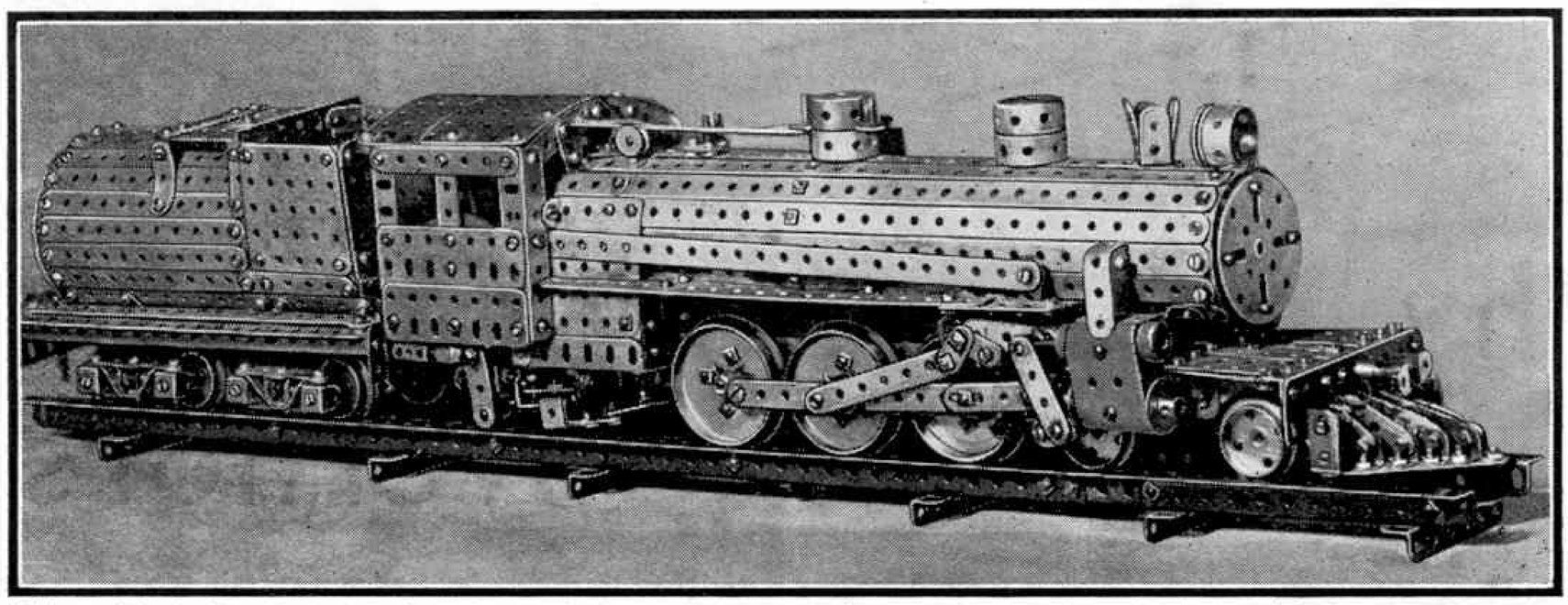
The locomotive model also is driven by an Electric Motor, which is fitted in the fire-box, the drive being taken direct to the front pair of driving wheels. The boiler is made up from Strips, and at the fire-box end is encased with $5\frac{1}{2}$" Flat Girders, which provide the characteristic appearance of the fire-box of the actual engine. The front of the boiler is enclosed by a $3\frac{1}{2}$" Pulley Wheel. Although it is built to a small scale the model incorporates a considerable amount of detail, including steam, water and vacuum gauges in the cab, and working valve gear. Both of these models show that a great deal of careful planning and patient work have been put into them.

The Second Prize model, which is a reproduction of a New Zealand Railway locomotive, is illustrated here. It is constructed to a scale of $\frac{1}{8}$ in. to 1 ft. and is fitted with Walschaerts valve gear. The reversing rod is connected to the reversing lever of a Clockwork Motor built into the fire-box, and arranged so that the lever protrudes into the cab for convenience of operation.

The cylinders are made up from Sleeve Pieces capped with $\frac{3}{4}$" Flanged Wheels. The main constructional details of the model have been carried out with great care, but more attention might profitably have been given to securing neater construction in the less conspicuous features.

One of the most original and cleverly constructed models entered in this Contest is that submitted by I. Rietti, who won Third Prize. It is an electric motor, and is constructed to operate on either 110 or 220 volts, a simple switching arrangement being provided to effect the change-over. The motor runs at a speed of 5,500 revolutions per minute, and generates sufficient power to drive Meccano models. Space does not permit a full description of this interesting model, and therefore I intend to deal with it in a special article in a future issue of the "*M.M.*"

Peter Kilpin sent a splendid working model of a coast lighthouse, in which the light is arranged to flash intermittently. The lighthouse is formed from Strips bolted at the top to a Hub Disc and at the bottom to a Circular Girder. Spaces are left in the structure to represent doors and windows. The power house, in which the mechanism is housed, is built of Flat Plates and cardboard. The flashing mechanism consists essentially of a revolving Bush Wheel with four Flat Brackets bolted to it. The Bush Wheel is driven by an Electric Motor, and the Flat Brackets are arranged to strike an insulated brass strip, an action that closes the electric circuit in which the lamp is connected. By carefully adjusting the metal strip the light may be made to flash for different periods of time.



This model of a New Zealand Railway locomotive by J. W. Gibbs, Wellington, N.Z., won Second Prize. It is built to a scale of $\frac{1}{8}$ in. to 1 ft. and is fitted with Walschaerts valve gear.

Other interesting entries are a reproduction of a heavy transport lorry by Mr. Rowlands, a member of the Old Charlton Meccano Club, and a working model locomotive coaling plant by L. Ison, Northcote, Australia. The latter is copied from an actual plant used at the North Melbourne locomotive depôt, which is the chief depôt of the Victorian State Railways. In operation the loaded wagons are pushed up a sloping track on to a hopper platform at the rear of the coaling plant. By releasing a catch the hopper is caused to cant and empty the coal into a bin. From here a conveyor mechanism driven by a Meccano Motor scoops up the coal and carries it to the top of the plant, where it falls out on to two $3\frac{1}{2}$" × $2\frac{1}{2}$" Plates that cover the main storage hopper. By opening these covers either or both hoppers can be filled. From the hoppers discharge chutes load the coal into the tenders of waiting locomotives.

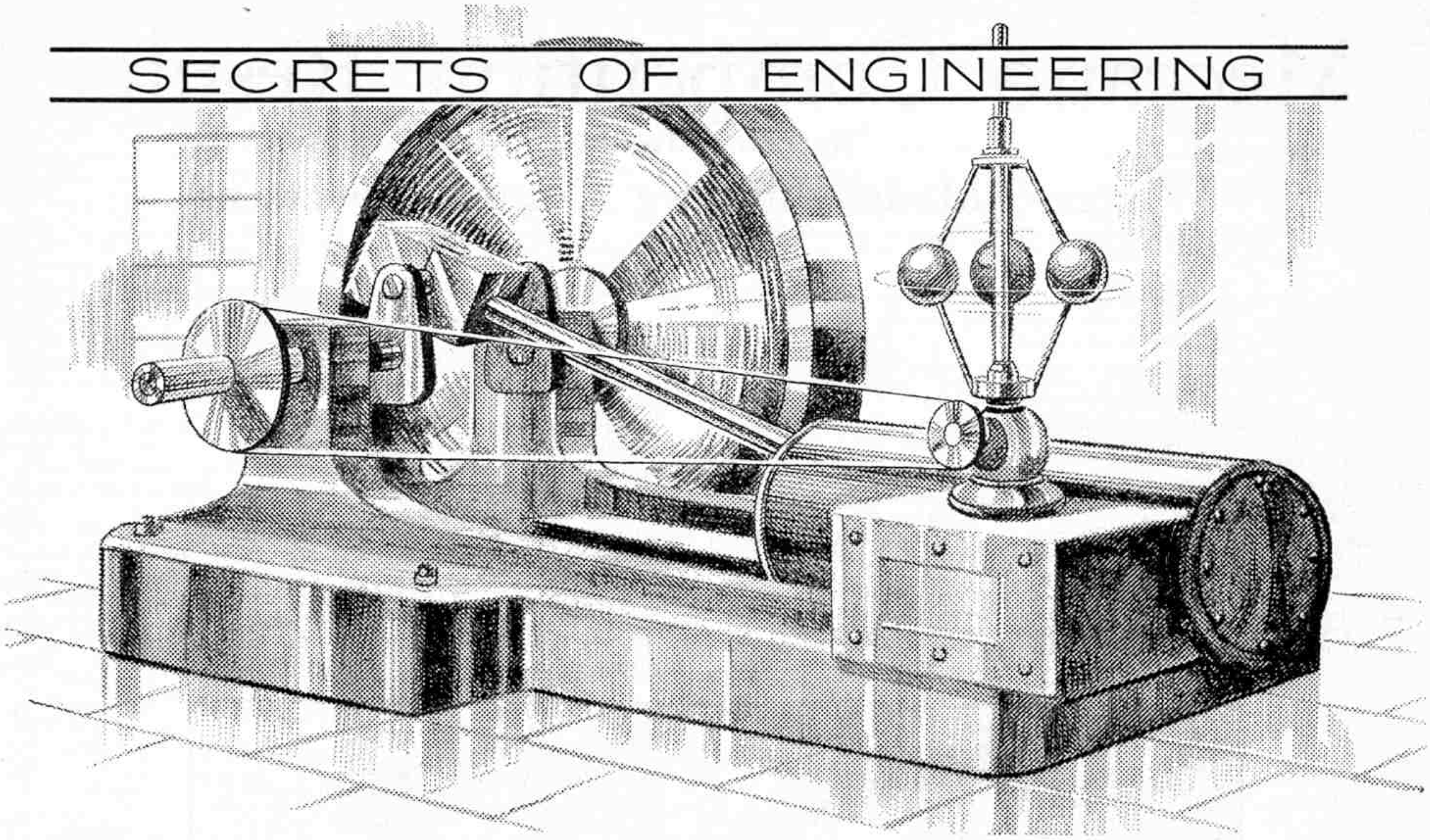
"Year's Best Model" Voting Contest

The massed votes of competitors in this Contest resulted in the following six models being chosen as the best illustrated in the "*M.M.*" during 1932. (1) C.N.R. Locomotive, by A. S. Park, Calgary, Canada, (Sept. "*M.M.*"). (2) Floating Crane, by J. Willems, Antwerp, Belgium, (Oct.). (3) L.M.S.R. Locomotive "*Fury*," by K. W. Cameron, Birkenhead, (July). (4) Butter Churn, by R. O. Jukes, Christchurch, N.Z., (August). (5) Leyland Motor Chassis, by E. Whalley, Blackburn, (May). (6) Bascule Bridge, by J. de Proft, Willebroeck, Belgium, (July).

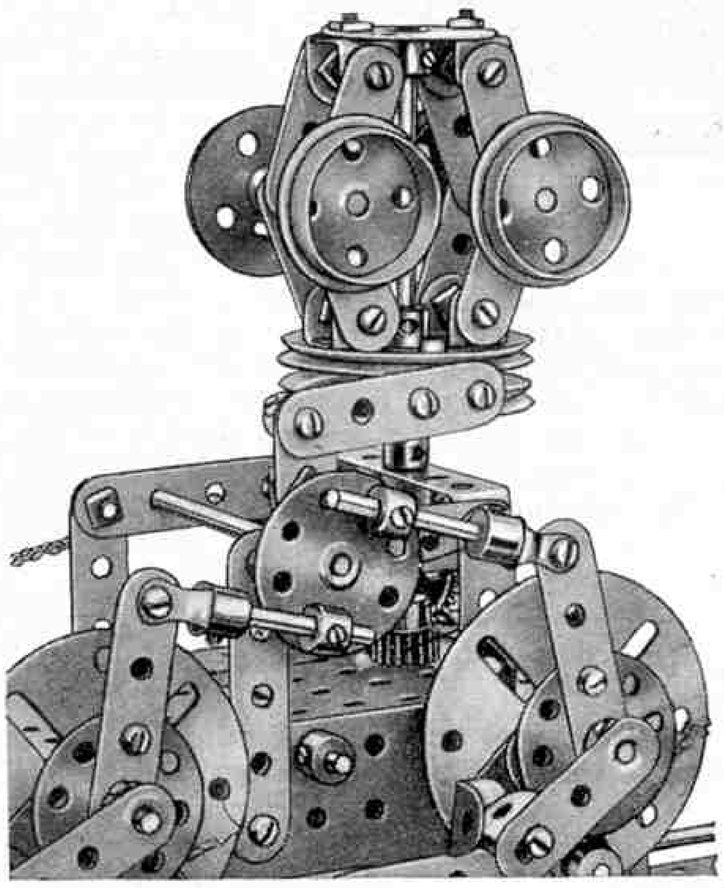
No competitor selected every one of these models and placed them in the order listed above, and therefore the prizes were allotted in order of merit to those competitors whose entries were nearest correct. The principal prizewinners are as follows :—

First Prize, Cheque for £2-2s. : I. Miller, Edinburgh. Second Prize, goods value £1-1s. : A. Cramp, Sydney, Australia. Third Prize, goods value 10/6 : K. Orams, Blenheim, Australia.

Prizes of Goods value 5/– (Home) :—K. Milburn, London, E.4 ; D. Morgan, Bromley, Kent ; A. Warren, Earlam Rise, Norwich ; R. Pearce, Bristol ; L. Luck, Portsmouth ; C. Eagling, London, S.W.14 ; A. J. Warren, Norwich. (Overseas) :—I. Hood, Ryde, N.S.W. ; J. Cesak, Winnipeg ; D. White, Roslyn, N.Z. ; R. Burbery, Lyttelton, N.Z.



Why do Engines have Governors?



A steam engine is designed to run under load at a certain speed. If the load on it is reduced suddenly, the engine tends to speed up rapidly and to " race," thus wasting steam and possibly causing damage. In order to prevent this a mechanism called a governor is fitted.

A well-known type of governor, of which an example is shown in the illustration above, consists of two or three balls mounted in such a manner that they are spun round rapidly when the engine is running. If the speed rises above the designed limit, the balls fly outward owing to centrifugal action, and this movement causes the supply of steam to be reduced, or even shut off. As the speed decreases the balls fall inward and more steam is passed to the engine. In this manner the governor makes the engine run at constant speed however much the load may vary.

The illustration on the left shows a governor of this type built with Meccano parts, and reproducing faithfully all the movements of similar mechanisms employed in real engineering.

PRICES OF MECCANO OUTFITS

Outfit	Builds	Price	Outfit	Builds	Price
No. X1	70 models	1/3	No. 3	687 models	27/6
No. X2	96 ,,	2/–	No. 4	753 ,,	52/6
No. OOO ...	162 ,,	2/6	No. 5 (Carton) ...	798 ,,	70/–
No. OO	189 ,,	3/6	No. 5 (Cabinet) ...	798 ,,	100/–
No. O	343 ,,	5/–	No. 6 (Carton) ...	844 ,,	125/–
No. 1	573 ,,	10/–	No. 6 (Cabinet) ...	844 ,,	155/–
No. 2	629 ,,	16/–	No. 7 (Cabinet) ...	889 ,,	415/–

MECCANO

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The Cats of Rancho La Brea—(*Cont. from p. 425*)

cats, inability to use the mouth while stabbing and slashing with the knife-like canines was compensated for by the extraordinary strength of the fore limbs.

In commenting on indications of the manner of life that *Smilodon* led, the authors of this study say that the destructive apparatus of the species is one of the most deadly combinations that has been found in any flesh-eating animal. So highly specialised was it that, like all delicate mechanisms, it frequently became disabled. Once the long, thin sabres were broken, this cat would be less effective in maintaining its position in the competitive life of the time than other large carnivores. Indeed, it is suggested that the extreme specialisation of this creature may have brought it to a stage where accidents occurred so commonly as ultimately to destroy the type.

The analysis of the structural characters of the sabre-tooth and of the great lion-like animal, *Felis atrox*, made by Dr. Merriam and Dr. Stock, shows conclusively that there were dissimilarities in both appearance and habits. In size, *Felis atrox* was larger than the living African lion by fully one-fourth. Among the flesh-eaters of Rancho La Brea its only rivals in size were the short-faced bears. In very large male representatives of this species the massiveness of the head is a striking feature, and the biting strength of its jaws must have been tremendous. With powerful jaws and teeth, with strong body and limb, and with the litheness, agility and swift-footedness of the large living felines, *Felis atrox* doubtless preyed upon the larger hoofed animals of the Rancho La Brea assemblage. The method of attack employed was very different from that of *Smilodon*, and doubtless it resembled much more nearly that characteristic of the lions and tigers of to-day.

Judged by the number of skeletons found at Rancho La Brea, *Felis atrox* was either less numerous than *Smilodon* or it yielded much less frequently to the lure of the flesh-baited tar pools, the ratios of the skeletons recovered being as 1 to 30.

The large number of sabre-tooth specimens found in the asphalt indicates that these beasts of prey were persistent visitors to the region bordering the pools. Accustomed as these animals were to feeding on thick-skinned, cumbersome, herbivorous mammals, and developing an attack, perhaps from ambush, *Smilodon* probably found easier prey at and in the tar pools. The miring of a live animal in the sticky tar and the lure presented by a creature in such straits would bring numbers of carnivorous animals and birds to these pools.

In view of the wealth of material taken from Rancho La Brea, and of its meaning, as disclosed by the scientist, it is no mere play of fancy to say that the past is reflected in these asphalt pools, for in them is found an almost complete representation of life as it was lived in the period that they span. In a paragraph in "*The Living Past*," Dr. Merriam gives this picture vivid characterisation.

"As the centuries passed, like a great procession streaming from surrounding hills and plains, the birds and beasts swept into the blackness of these pools. Here was gathered a multitude of witnesses, who through the 'still lapse of ages' waited the time when in the unavoidable evidence of their reality they were to bring a living story of the past before us. They appear to-day not as formal revelation, but as clear evidence, which through this staying of the hand of destruction permits us to look into the living world of a past eon."

We are indebted to the courtesy of the Carnegie Institute of Washington for the information contained in this article.

Coastal Motor Boats—(*Continued from page 418*)

entrance to Kronstadt. The attack was due to Agar's own initiative, and was carried out entirely without support from other vessels. He attacked at dawn, and succeeded in evading a protective screen of four Bolshevik destroyers. He torpedoed the "*Oleg*" at short range, and she sank immediately.

Lieut. Agar had been alone with his C.M.B. in the Baltic; soon after his success it was decided to send out a flotilla. The difficulties of navigation in the shallow water, in which there were many minefields, were very great. It would have been impossible for large vessels, or even destroyers, to have made a successful attack on Kronstadt, but it was thought that there was a good chance for the C.M.Bs. to attack the warships inside Kronstadt harbour, photographs taken from aeroplanes having shown the positions of the different vessels. Since the "*Oleg*" had been torpedoed, the Bolsheviks had not risked leaving another large vessel outside the harbour, and only a destroyer was left to guard the entrance. At about 10 p.m. on the night chosen for the attack the eight C.M.Bs. selected for the task pushed off from H.M.S. "*Vindictive*," where they had been berthed during the day. The weather conditions were ideal, a dark night and a flat calm; and the C.M.Bs. proceeded to the rendezvous at about 18 knots. On the way Lieut. Agar and the two following C.M.Bs. were lost by the remainder, who at a pre-arranged time proceeded at full speed, passing between two outlying batteries soon after the commencement of the aerial bombardment that had been planned to coincide with the C.M.Bs. attack. According to plan Lieut. Bremner C.M.B. 79A entered the harbour first, and torpedoed a submarine depot ship, his boat being disabled immediately afterwards. As C.M.B. 88BD was coming through the entrance Lieut. Dayrell Reed was shot through the head. Lieut. Steele immediately took command, and succeeded in torpedoing two other ships. About this time Lieut. Agar and the remaining three boats arrived. Lieut Napier C.M.B. 24A according to plan fired a torpedo at the destroyer anchored outside, but was afterwards sunk himself. Lieut. Brade C.M.B. 62BD entered the harbour at high speed, but met with disaster as soon as he was inside. Both he and Lieut. Bremner in C.M.B. 79A succeeded in getting their disabled boats outside the harbour, where Lieut. Bremner blew up his boat. Lieut. Brade then fired a torpedo at a destroyer leader and was sunk by gun fire, the only survivors of the two boats being Lieut. Bremner, wounded in 11 places, one Chief Motor Mechanic, and one Stoker Petty Officer. Lieut. Agar waited outside the harbour for some time to give any assistance to anybody who needed it, and before leaving fired and hit a transport in the Military Harbour.

All the boats that survived the attack had many narrow escapes, and as they returned the forts were fully prepared for them with searchlight beams on the water. Those in the boats feared that there was little chance for them to get through, but an airman who appreciated the position flew down into the beam of light from the particular fort that they were passing, and then climbed rapidly. Those in charge of the searchlight apparently could not resist following him with their beam, and the boats passed through invisible to the gunners. Any attempt to describe the gallantry of the officers and men who took part in this action, which is unique in naval history, must be inadequate. Decorations were awarded to all the officers and men, and V.C's. to two of them.

For the information upon which this article is based we are indebted to the courtesy of John I. Thornycroft & Co. Ltd.

Camels in use as transport animals at an Indian Port. **(See special article "Curious Modes of Transport" on page 444).**

Goods Train Control System—(*Cont. from p. 440*)

Although our main description here has been confined to control in its relation to goods traffic operation, the central control operations cover passenger train working also, with the object of helping such trains to maintain their schedules. Since 99 per cent. of passenger trains have a schedule laid down for them, it is obvious that the function of the controller in relation to passenger trains may be defined quite simply as the helping of signalmen and stationmasters to remove any circumstances that may arise to prevent the maintenance of passenger train schedules. Thus main line trains may not be kept for late connections but special arrangements may be made to enable through services to be maintained. In practice, the central offices do not take great account of the passenger trains moving along the system, and the responsibility for working these devolves largely upon district controls.

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The Meccano Guild

Speed Boat Racing in Summer

June is the month of fine weather and long days. Members have not yet dispersed on holiday, and profiting by the experience of previous years, the activities of most Meccano clubs have been transferred to the open air, with the result that members continue to keep together and to play cricket and take part in other games and healthy outdoor pursuits in the true Guild spirit.

This year the summer programme of many Meccano clubs includes Hornby Speed Boat meetings. These are a great attraction, for they give members splendid opportunities of trying out the capabilities of their speed boats, and the races organised arouse great excitement among the onlookers as well as among the owners of the vessels taking part.

Officials of clubs that have not yet added this item to their programme will be well advised to think seriously about doing so. A proportion of members of most clubs possess speed boats, and meetings of this kind arranged for them provide an interesting variation of the usual programme. Even those who do not own speed boats will be eager to help, for all can share in the pleasure and excitement of racing. Ponds and lakes suitable for model boats are to be found in most districts, and very few clubs will lack suitable opportunities of enjoying this healthy open air pursuit.

Finding Camp Sites

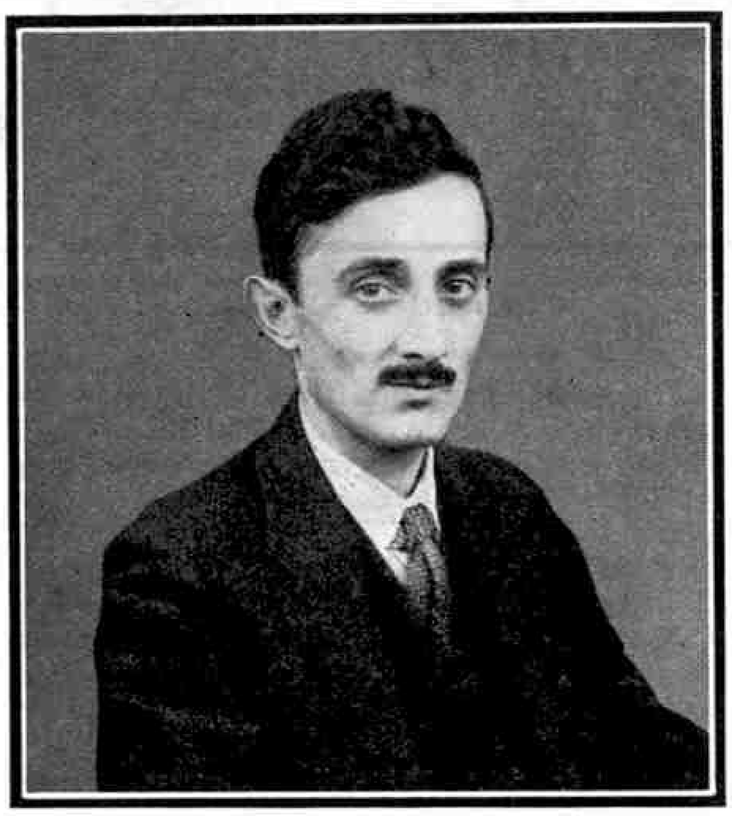
Camping continues to grow in popularity year by year, and Meccano clubs are taking a prominent share in the movement. Many officials who are organising camps this summer have already made their preparations. Those who have not yet come to a final decision, and are in search of a good site, will find valuable help in a handbook for campers and hikers issued by the L.M.S.R. This contains full details of more than 400 camping grounds in the area served by the railway, and the accompanying descriptions of the districts in which the sites are located will give Leaders a good idea of the nature of each. The handbook is free, and anyone wishing to obtain a copy should make application at the nearest L.M.S.R. station. Useful help of the same kind is afforded by similar publications of other railways.

I should like to remind Leaders that special terms are available for organised parties, and the concessions enable a distant camping ground to be selected without adding greatly to the expense of a holiday of this kind. Thus members taking part may roam further afield than on ordinary occasions and explore new and interesting country.

The greatest fun in camp life is obtained when parties from two or more clubs unite, for the increase in numbers adds to the general resources of the community and helps to keep things alive during the camping period. I hope that neighbouring clubs, in particular, will keep this in mind when arranging for a camping holiday.

Meccano Club Leaders

No. 65. Mr. R. W. Shooter



Mr. R. W. Shooter has been Leader of the Hornsea M.C. since its formation. The club was affiliated in October, 1928, and Mr. Shooter has included many novel features in its programmes, making extensive use of his cinematograph camera and projector in order to add interest and variety.

Recruiting Efforts

While the pleasures of the summer programme are being enjoyed, the needs of the winter season should not be overlooked. There are times during the summer when outdoor pursuits cannot be followed, and then members should be encouraged to make use of the club room. Indoor games may be substituted when open air activities are impossible, but a little time should be spared for overhauling club material, or cleaning and decorating the club room and re-arranging its contents. Work of this kind is most easily carried out in the summer, when indoor activities are at a minimum; and if it is completed now club hours during the winter sessions can be wholly devoted to active work in model-building and other hobbies.

Another branch of club work that should not be abandoned during the summer is recruiting. There is a constant demand for new members in order to increase club resources and to extend activities, or to fill up gaps that follow unavoidable withdrawals. A formal recruiting campaign is not practicable during the summer months, and what is chiefly required now is personal effort on the part of members. They can show their loyalty to the club by taking part enthusiastically in its summer activities and by introducing friends to take part in excursions, or to join the cycling and speed boat sections. Intending members are entitled to see every phase of club life, and much can be done in a quiet way if their attention is drawn to the opportunities for enjoyment throughout the year that membership brings with it.

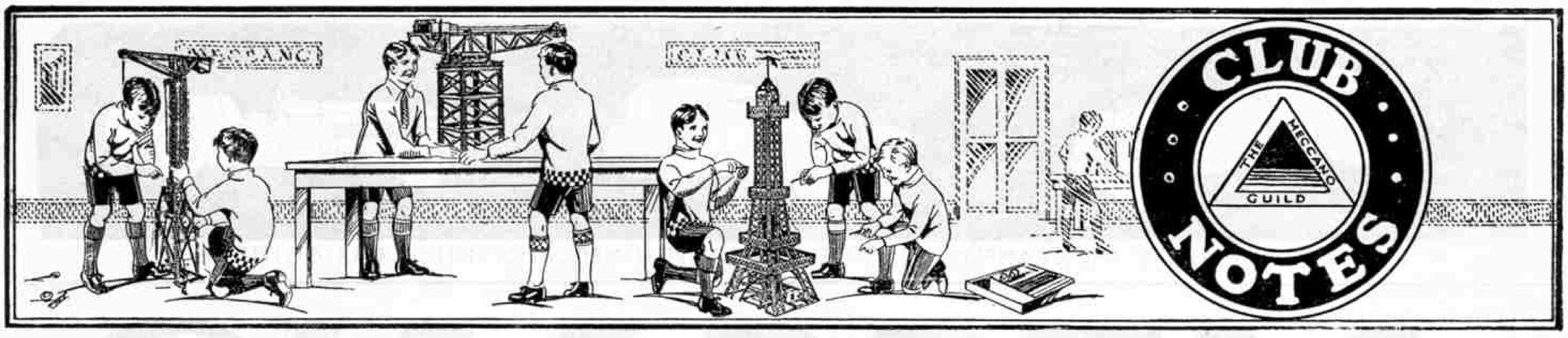
The Guild Overseas

I am continually receiving evidence of the steady growth of interest in the Guild and club movement overseas, but recently this was emphasized in a remarkable manner when Affiliation Certificates for three clubs in widely separated countries were prepared together. The first was for the newly constituted Mexico D.F. Meccano Club, the pioneer of the Meccano Guild in Mexico; the second for the Hilversum M.C. in Holland; and the third for the Sandefjord club, Norway, which has been reorganised and given a new name. All three are welcome recruits to the Meccano Club movement, and I hope that their meetings will continue to give enjoyment to their members for many years to come.

Proposed Clubs

Attempts are being made to establish Meccano Clubs in the following places, and boys interested in becoming members should communicate with the promoters whose names and addresses are given below:—

EGYPT—Vladimir Souccar, 17 Rue Fouad 1er, Alexandria.
LONDON—A. H. Smith, 17, Fletching Road, Clapton, E.5.



East Hull M.C.—First Prize in the club's Model-building Contest was awarded to R. Hyam, whose model of a 100-ton Crane gained full marks. Other Model-building Contests have been designed to develop speed and resource, and the ability to make as much as possible of a few parts. A talk was given by Sergeant-Major L. Smith, D.C.M., on his experiences in India. Visits are now being paid to local works and the Hull Museums. Club roll: 15. *Secretary:* H. Acklam, 103, Newcomen Street, Hull.

Hutton Modern School M.C.—The first meeting of this newly-affiliated club was a Construction Night, and members gave evidence of skill in Model-building. The next meeting was the inauguration of the club's Hornby Train layout, an excellent track being designed in readiness for future operations. A combined Games Tournament was held on Invitation Night, when non-members were present, marks earned in Table Tennis, Bagatelle and Air Rifle Shooting being added together in deciding prizewinners. Visits have been paid to the works of the Phœnix Electric Company, the Bradford City Fire Station and various woollen mills. Club roll, 31. *Secretary:* S. Major, Hutton Modern School, Eccleshill, Bradford.

Orwell M.C.—An intensive series of Model-building Evenings has been held, and all members have been very keen on this section of the club's programme. Mr. A. Miller, Assistant Leader, has resigned owing to leaving the district, and a Leather Cigarette Case and Lighter were presented to him by the members. Club roll: 20. *Secretary:* Miss E. D. Hepburn, Rutherburn, Milnathort.

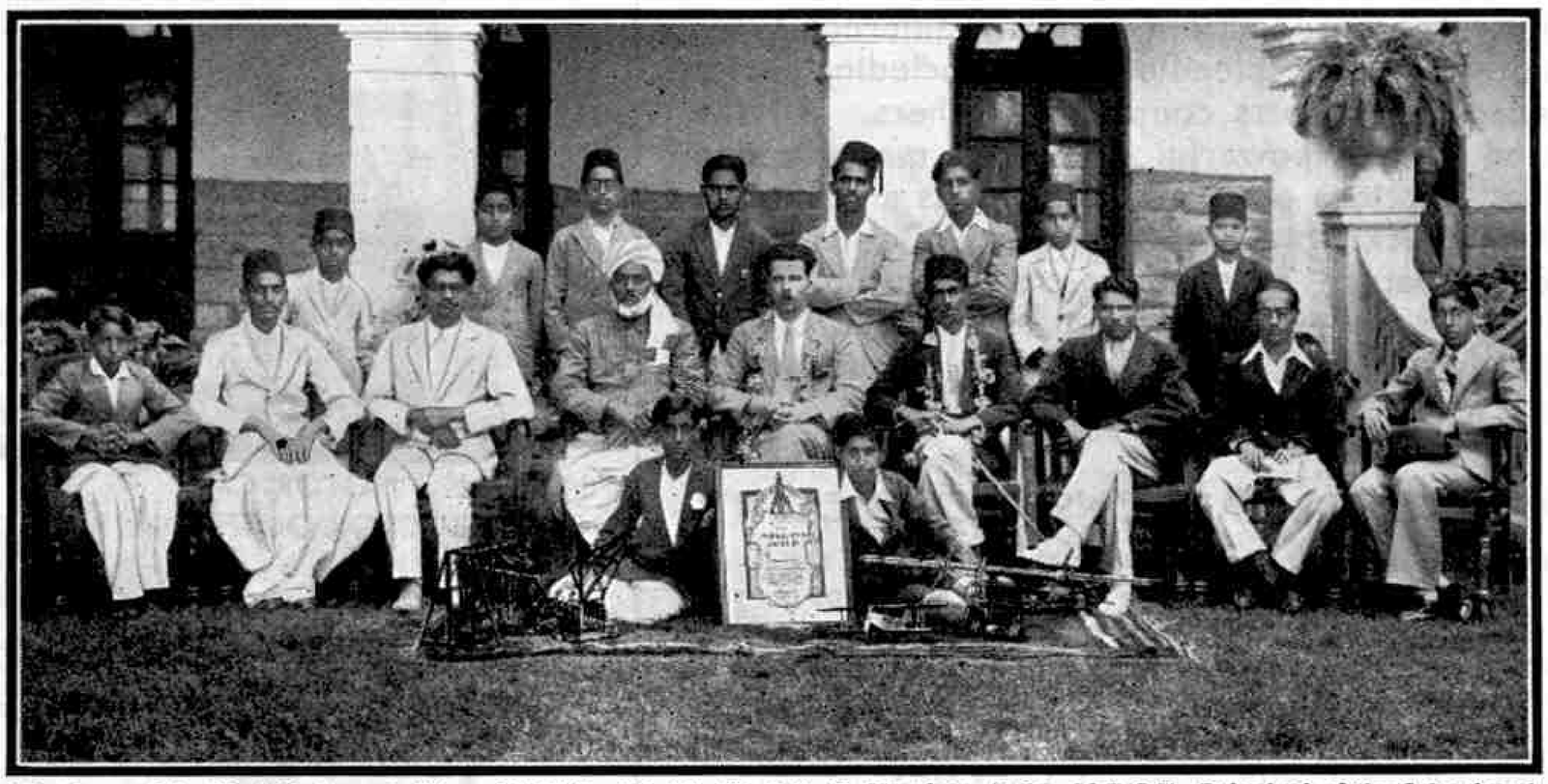
St. Mary's (Bocking) M.C.—On Model-building Evenings "Simplicity" Contests have been held, and also others in which Animal Models and Motor Cars equipped with gear wheels to enable them to climb have been constructed. A Wireless Set has been constructed for use in the club room. An innovation is Detective Story Evening, introduced by the Very Rev. E. Rogers, President of the Club. The President gives brief details of an imaginary crime and each member in turn develops it into a complete detective story. Members have become ingenious in devising interesting tangles and suggesting ingenious solutions. Club roll: 23. *Secretary:* B. H. Holdaway, Church Street, Bocking.

Wyggeston Grammar School M.C.—A splendid Exhibition of models was given on the School's "Open Day." An original model of a Leicester Corporation Refuse Motor Van was highly commended by the visitors, of whom about 300 were present, and the remaining models were remarkable for the care taken in their construction. A Meccano Workshop also was on view, and was made the subject of a demonstration that was particularly useful to younger members of the club. Other events have included lectures on "*Railway Signalling*" and "*Scottish Railways*," a Hornby Train Display, and a Cinematograph Evening. A Story Night also has been held and the Spring Session concluded with Tuck Night, at which prizes were distributed. Club roll: 42. *Leader:* Mr. G. F. Reynolds, Wyggeston Grammar School for Boys, Leicester.

Whitgift School M.C.—An outstanding event was the visit to Liverpool, which was reached at 6.50 a.m. on 11th April, after an all-night journey. After visiting the Pier Head and seeing the arrival of the Dublin boat, members were shown round the factory of Meccano Limited, afterwards being addressed by Mr. F. Hornby, President of the Guild. The rest of the day was devoted to the inspection of the Docks and a trip on the Overhead Electric Railway. Club roll: 14. *Secretary:* M. M. Young, "The Corrie," Manor Way, Purley, Surrey.

Fulstow Junior M.C.—In a special Model-building Contest entrants in the Senior Section were allowed 50 Meccano parts, while those in the Junior Section were allowed 30. The entries were judged by Mr. W. C. Jones, whose remarks on the models were greatly appreciated by the members. Talks by the secretary on "*How a Motor Car Works*" and "*How a Locomotive Works*" were illustrated by means of Meccano models. Lantern Lectures on "*Bournville*" and "*Lincolnshire*" have been given, slides being kindly loaned by Cadbury Bros. Ltd. and the L.N.E.R. respectively. The club celebrated its Fourth Birthday by a Social Evening. Club roll: 16. *Secretary:* J. C. Phillips, Post Office, Fulstow, North Thoresby, S.O. Lincs.

Wallington County School for Boys M.C.—The chief interest of recent meetings has centred in the club's Hornby Train layout. An excellent timetable was worked out, but signalling arrangements were inadequate and members therefore made special Colour-light Signals and Switches, using Meccano parts. On trial these proved satisfactory. The suggested construction of a Channel Tunnel was fiercely debated for two hours, a motion in favour of the scheme being carried by one vote. Club roll: 15. *Secretary:* E. Cheeseman, 38, Wordsworth Road, Wallington, Surrey.



Members of the Sind Madressah (Karachi) M.C. with Mr. H. F. L. T. Harrison, B.Sc., M.R.S.T., Principal of the School and President of the club, in the centre. Mr. S. A. Gazder, Leader, is second from the right, and Akhtar Abbas, secretary, second from the left, in the middle row. The club was affiliated in August, 1932.

Anderson Baptist (Reading) M.C.—Members' Evenings are held regularly, various members then giving short talks on subjects of special interest. A Table Tennis Tournament has been decided and the relative merits of Rugby and Association Football were debated. The Rugby supporters were very enthusiastic, but were outvoted. Social Evenings and Sing-Songs are popular features of the programme. Club roll: 27. *Secretary:* R. E. Hoffler, 27, Pitcroft Avenue, Reading.

Dagenham M.C.—An increase in membership has made removal to a larger club room necessary. The club celebrated its First Birthday by a Surprise Cinematograph Show and a talk on the history of the club by S. Pashley, the secretary and originator. The occasion also was commemorated by an Exhibition attended by more than 100 visitors, who were greatly attracted by the many excellent models built by members. Club roll: 60. *Secretary:* S. Pashley, 84, Holgate Road, Dagenham, Essex.

St. James's (West Streatham) M.C.—Ordinary club work was interrupted to allow members to help in making the Church Bazaar a success. Model-building was then resumed with greater enthusiasm than ever and many extensive contracts have been undertaken. At an "Open Meeting," which was well attended by parents and friends of members, a Lantern Lecture on "*A Visit to Bournville*" was given, slides being kindly provided by Cadbury Bros. Ltd. Club roll: 30. *Secretary:* C. Mizen, 64, Fallsbrook Road, Streatham.

Regent Street School M.C.—Lantern Lectures have been given on "*London*" and "*English Cathedrals.*" Debates have been held and Table Tennis and Draughts Tournaments arranged. Active Model-building operations have greatly interested members, and the club continues to make excellent progress. Club roll: 102. *Secretary:* W. Jones, 123, Lynden Lea, Bury Street, Heywood, Lancs.

Plymouth M.C.—Mr. A. A. Puckey gave a lecture on "*The Steam Engine,*" demonstrating its working by means of six model Steam Engines built by himself. Members were allowed to work the models, and examined these so closely that they were able to build excellent Meccano reproductions for the next meeting of the club. A model Steam Engine is being presented to the club by Mr. Puckey and will be given as a prize in a competition. Models of Plymouth Tramcars and Omnibuses are being built, and attractive works' visits have been planned. Club roll: 67. *Secretary:* G. Symons 6, Holland Road, Peverell, Plymouth.

AUSTRALIA

Melbourne M.C.—Visits have been paid to the Clock Tower of Flinders Street Station, from which magnificent views were obtained; and to the North Melbourne Locomotive Depot, where the secretary, who is employed at the Depot, showed two parties round and enabled members to ride in the cab of a "Pacific" round the reversing loop. The secretary has built a splendid model of the coaling plant at this Depot, model trains being run to receive loads of sunflower seeds, representing coal. Other special models exhibited at meetings have included a Hydraulic Crane, a Weighbridge, a Signal Gantry and a Steam Engine. Club roll: 48. *Secretary:* L. Ison, 8, Hayes Street, Northcote, N.16, Victoria.

CANADA

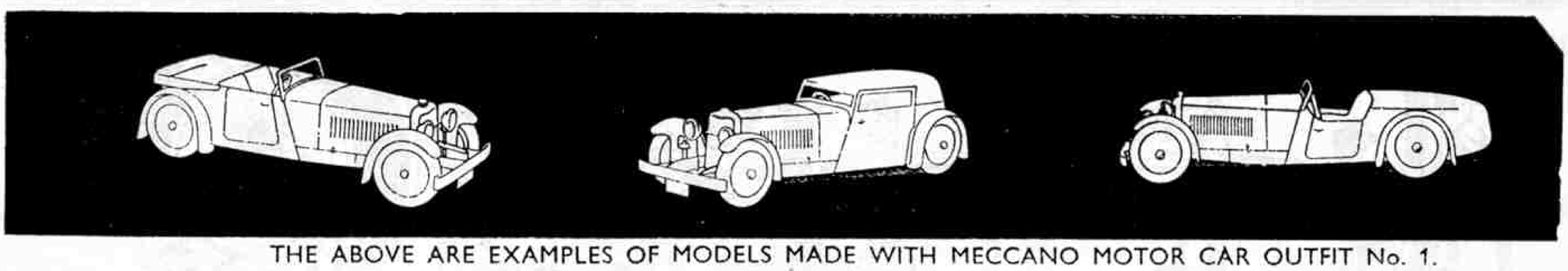
Westmount M.C.—The sectional system has been introduced, each group containing not more than ten members, and being awarded points for attendance, model-building and games. The sections are named after famous scientists or engineers and now include the "Michael Faraday," "Edison," "George Stephenson" and "Marconi" groups. Models of the Quebec Bridge and the Blocksetting Crane were built by members for demonstration during an address on "*Hobbies in a Boy's Life,*" given to the Westmount Rotary Club by Mr. W. A. Buckley, President of the Club. The Hornby Train layout is operated at every meeting, and Wireless Receiving Sets also are being made by members. Club roll: 35. *Secretary:* F. S. Thomson, 695, Grosvenor Avenue, Westmount, Montreal.

NEW ZEALAND

Wellington Boys' Institute M.C.—Summer visits included inspection of woollen mills and a meat packing factory at Petone, in addition to the general assembly plant of General Motors Ltd. A lecture on Stamps was given by Mr. Coleman, and Travel Talks have recommenced. New cupboards have been provided in the club room and a monthly "News Sheet" has made its appearance. New members are wanted and a recruiting scheme has been organised. Club roll: 20. *Secretary:* E. Speers, 70, Cuba Street, Petone.

SOUTH AFRICA

Malvern M.C.—Specially interesting events of a crowded summer session have included a very successful sports meeting, when the "Ramblers" gained highest sectional points; a Christmas Party to which children from the Epworth Home were invited; and an enjoyable picnic at Forest Hill, which concluded with tea kindly provided by Mr. and Mrs. Roberts on the lawn of their home. Other meetings have included Debates, Competition Nights, and Camp Fire Nights, and members attended the inaugural rally of the Transvaal Meccano Clubs Union, which was presided over by Miss Harris in the absence of Mr. A. E. Harris owing to illness. A Model-building championship for members of the Union has been suggested. Rambles and Cycle Runs have been held, and there was special interest in a "Find it Out" Night. *Leader:* Mr. E. Sykes, P.O. Box 8, Cleveland, South Africa.



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No. 1 Outfit is available in four different colour combinations—Red and Light Blue, Light Blue and Cream, Green and Yellow, and Cream and Red. It is supplied complete with powerful Clockwork Motor.

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Larger models of a superior type can be built with No. 2 Outfit. They are perfectly designed, beautifully finished and the most attractive examples of constructional engineering ever invented for the delight of boys. Their handsome and realistic appearance may be judged from the illustrations below.

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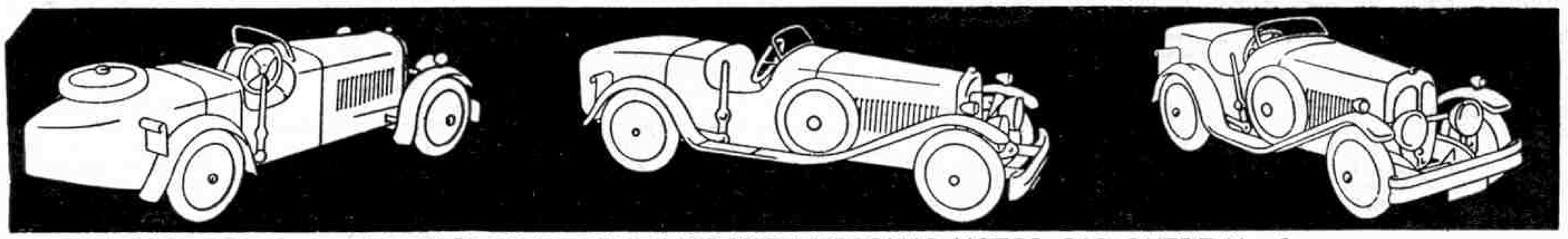


THE ABOVE ARE EXAMPLES OF MODELS MADE WITH MECCANO MOTOR CAR OUTFIT No. 2.

Branch Notes

WEST DULWICH AND HERNE HILL.—An Efficiency Badge is now awarded to the member who does the most creditable work, the award being made monthly. Competition for the honour between "Baltics" and "Pacifics," the two sections of the Branch, is very keen, as the holder of the Badge scores points for his team. At the Annual Exhibition the Branch track was in continuous operation and visitors were greatly interested. A visit was paid to Croydon Aerodrome, where the hangars were inspected and several machines were seen arriving and departing. Secretary: J. Nunn, 70, Herne Hill, London, S.E.24.

WEST LEIGH (LEIGH-ON-SEA).—The Certificate of Incorporation has been received with enthusiasm. Members are becoming expert in operating trains according to timetable. "Hat Night" proved popular, each member replying to a question written on a slip of paper drawn by him from a hat. A visit has been paid to the Shoeburyness Motive Power Depot. Correspondence is exchanged with the Birmingham Branch, and the letters describing operations on the Branch tracks are read at the meetings. Secretary: K. G. Cross, "Knowle Villa," 129, Southsea Avenue, Leigh-on-Sea.

SUTTON AND DISTRICT.—Regular meetings are held on Saturdays. An extensive track has been laid down, and on this two electric and four clockwork trains are run. Special attention is paid to correct signalling, and in order to improve operations in this respect a visit of observation was paid to Sutton Junction Signal Box. Secretary: D. Wakely, Hillbury, Holland Avenue, Cheam, Surrey.

WHITGIFT SCHOOL.—The two sections of the Branch hold regular track meetings and other events have included visits to Nine Elms Station and the Croydon Electricity Works. An attractive talk on "*The Electrification of the S.R.*" was given. In an interesting contest members were asked to make a list of railway items, or terms, using only the letters contained in a German word of 50 letters. The task proved so absorbing that it was repeated the following week by both senior and junior sections. A particularly attractive excursion was the visit of the Branch and the associated Meccano club to Liverpool, where the Meccano factory and the Docks were inspected. Secretary: M. M. Young, "The Corrie," Manor Way, Purley, Surrey.

1ST BOLTON.—A permanent Branch room has again been secured and a continuous electric double-track layout planned. This includes two large sidings and gives splendid opportunities for interesting track meetings. A visit has been paid to the Bolton L.M.S.R. Locomotive Depot, where a Sentinel Cammell rail car was seen, in addition to the usual types of locomotive. New members are required, and those interested are asked to communicate with the Secretary, H. T. Council, 50, Lena Street, Bolton.

WIMBORNE GRAMMAR SCHOOL.—The Branch track provided many interesting evenings, particularly after the shunting facilities in all stations were improved. "Meccanoville" is the only station not handling goods traffic, but shunting is required there, for a bay platform serves the needs of local passenger trains. The layout was dismantled, and rolling stock and scenery cleaned and packed away, in order to allow members to redecorate the Branch room. All the parts were carefully overhauled before the track was relaid in readiness for the summer Exhibition. Secretary: J. K. Bennett, 120, Newington Causeway, London, S.E.1.

Members of the Woodford Branch, No. 54. Chairman, Mr. D. Beavis; Secretary, J. H. Skelt. This Branch was incorporated in June, 1929, and an attractive programme of Games, Contests, Debates, Visits and Lantern Lectures, in addition to regular track meetings, is followed. Members are grouped in "Houses" and a Cup is presented periodically to the House with the best attendance record.

PORTSMOUTH NORTH END.—Films on "*Zoo Life*" and other interesting topics have been shown with the aid of a small cinema projector. At a special meeting members constituted themselves into surveyors and planned a new and more extensive track. The new scheme was quickly put into operation and the best running since the formation of the Branch has been the reward of the hard work put in. Unfortunately the club room is no longer available, but the experience gained will enable an even better layout to be planned when track meetings re-commence. Secretary: C. Mortby, 35, Beresford Road, North End, Portsmouth.

BIRSTALL (LEICESTER).—The track room is a large hut in the garden of the secretary's home, and is to be enlarged in order to enable a more extensive track to be accommodated. Track meetings have been devoted to the running of express passenger and goods trains. Cinematograph displays have been given, one film showing famous British express trains. Extensive preparations were made for the club's Exhibition and the display of posters, prepared by the secretary, and the interest aroused by reports of members ensured a large attendance and a successful Exhibition. Secretary: G. B. Gibson, 49, Front Street, Birstall, Leicester.

FIRST BOURNEMOUTH.—Excellent track work is carried out at each meeting and various types of layouts have been tried. Members gain the greatest fun from running a series of fast express passenger trains. A proposal has been made to form a Hornby Speed Boat section during the summer. More members are still required and the secretary will be pleased to hear from those who wish to join. Secretary: R. Common, 13, Uplands Road, Winton.

AUSTRALIA

SYDNEY.—The Branch has been reconstituted and at the first meeting under the new arrangement traffic officials were appointed and rules drawn up. Signals have been overhauled and alterations made to the Branch track, a portion of which has been relaid in order to improve facilities at the terminus. A branch line is to be laid down, and as the gradients on this will be severe, the adoption of electric traction is being considered. Secretary: W. J. T. Watson, 595, Parramatta Road, Leichhardt, New South Wales.

Proposed Branches

LONDON—H. Green, 25, Fielding Road, Bedford Park, W.4.

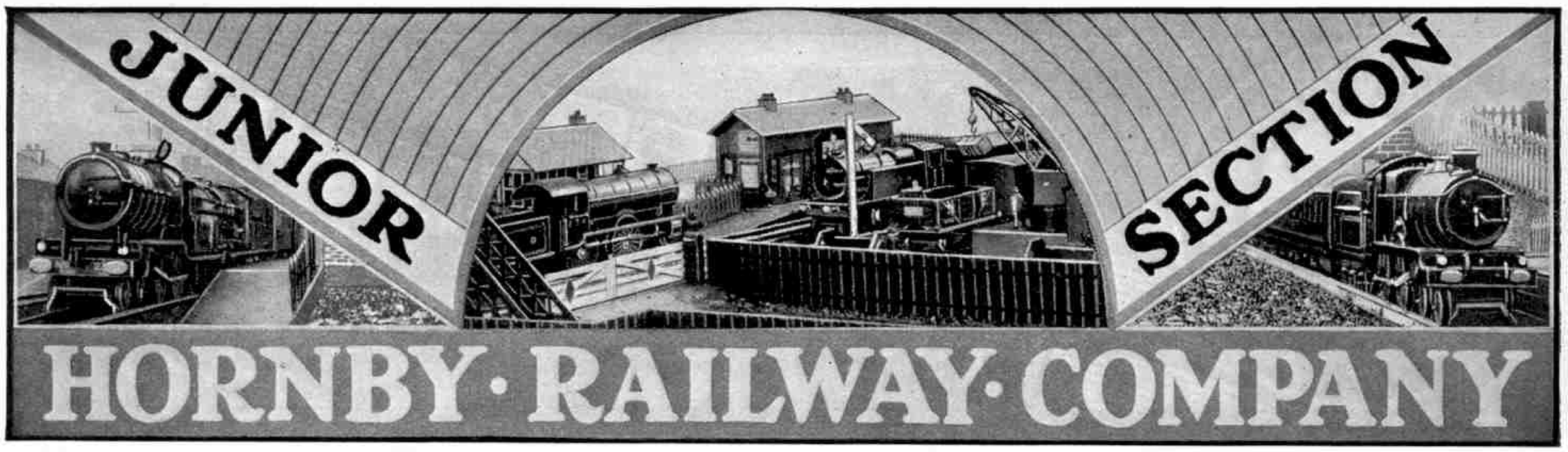
STOKE-ON-TRENT—R. Chase, 767, London Road, Trent Vale.

WOLVERHAMPTON—P. S. Hale, Crayford, 15, Fawdry Street.

BARKING—C. Titmarsh, 7, Surrey Road.

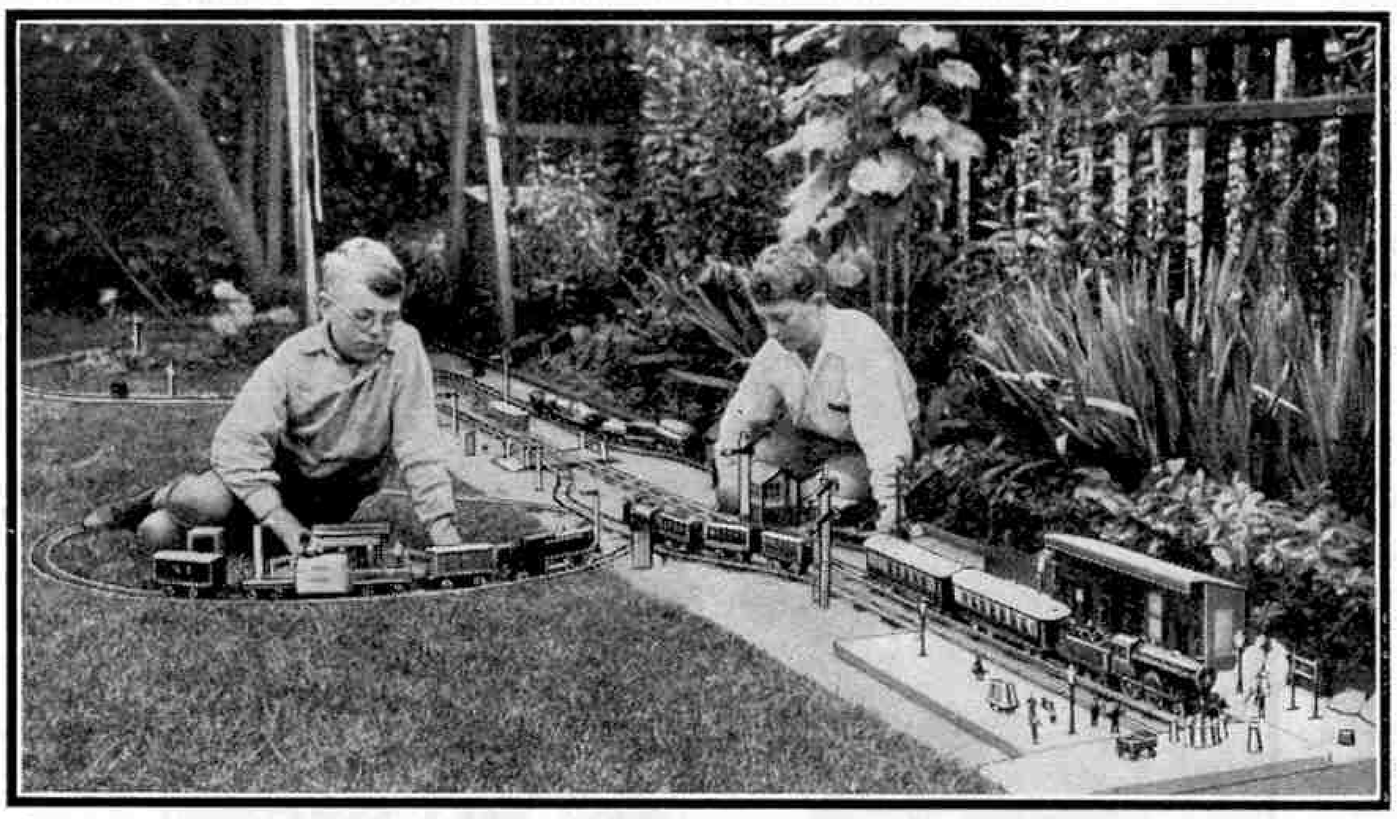
MANCHESTER—E. Grant, 26, Sandown Crescent, Gorton.

WORMIT—C. Woods, Woodhaven, Wormit, Fifeshire.



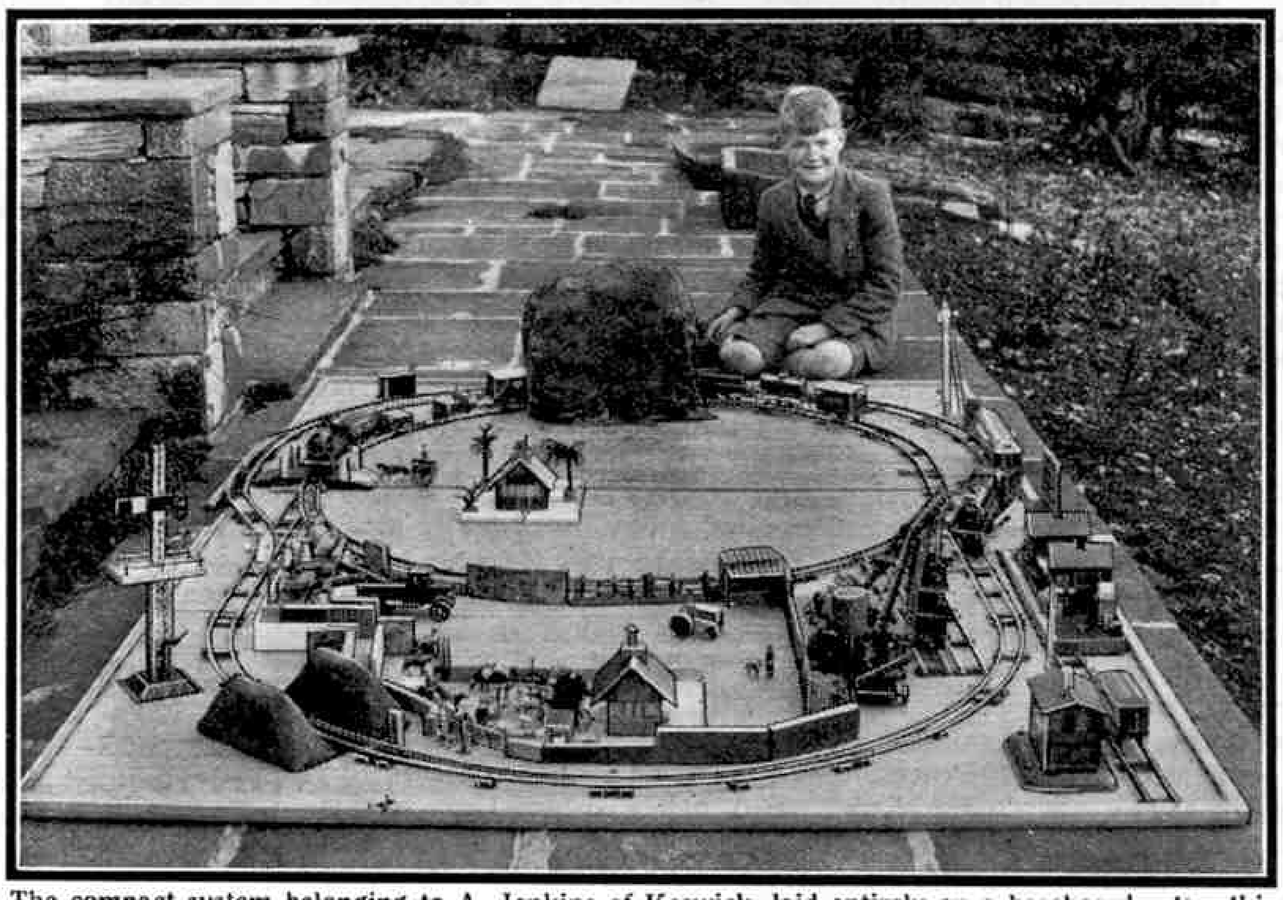
LIV.—RAILWAYS OUT OF DOORS

AS a general rule there is some slackening of activity on miniature railways as the summer days grow longer and brighter and outdoor activities engage the attention of practically all our readers. The idea then occurs to many that if a Hornby layout could be arranged out of doors some very attractive schemes might be followed up in a manner impossible indoors. As a result the H.R.C. staff at Headquarters are constantly asked during the summer whether a permanent outdoor line can be laid with Hornby rails. It must be said at once that the Hornby System is designed for indoor use, and is quite unsuitable for continuous outdoor service. Exposure to wet or damp weather for even a very short period would cause the track to rust, with the result that poor running would be experienced, and points probably would become unworkable. It would not be wise to leave the track out even for a single night in our damp climate.



A fine Hornby layout in the garden. This is a joint system operated by A. Nicoll and T. H. Cloud of Ilford, the main line being laid on the path and a branch line on the lawn.

On the other hand it is quite possible to lay down a line for a day's running in fine dry weather, but the whole of the material must be packed up and taken in again when finished with, the rails and other components being carefully wiped over before they are put away. Great care should be used in this wiping operation if the railway should happen to be caught in a sudden shower. Apart from damp, the only other source of trouble is dust or grit that may find its way into the mechanisms of the locomotives, or the bearings of the rolling stock. Where the soil is sandy, or very dry, it is almost impossible to avoid this, but the careful use of a small "mop" paint brush moistened with petrol or paraffin will be sufficient after each day's running.



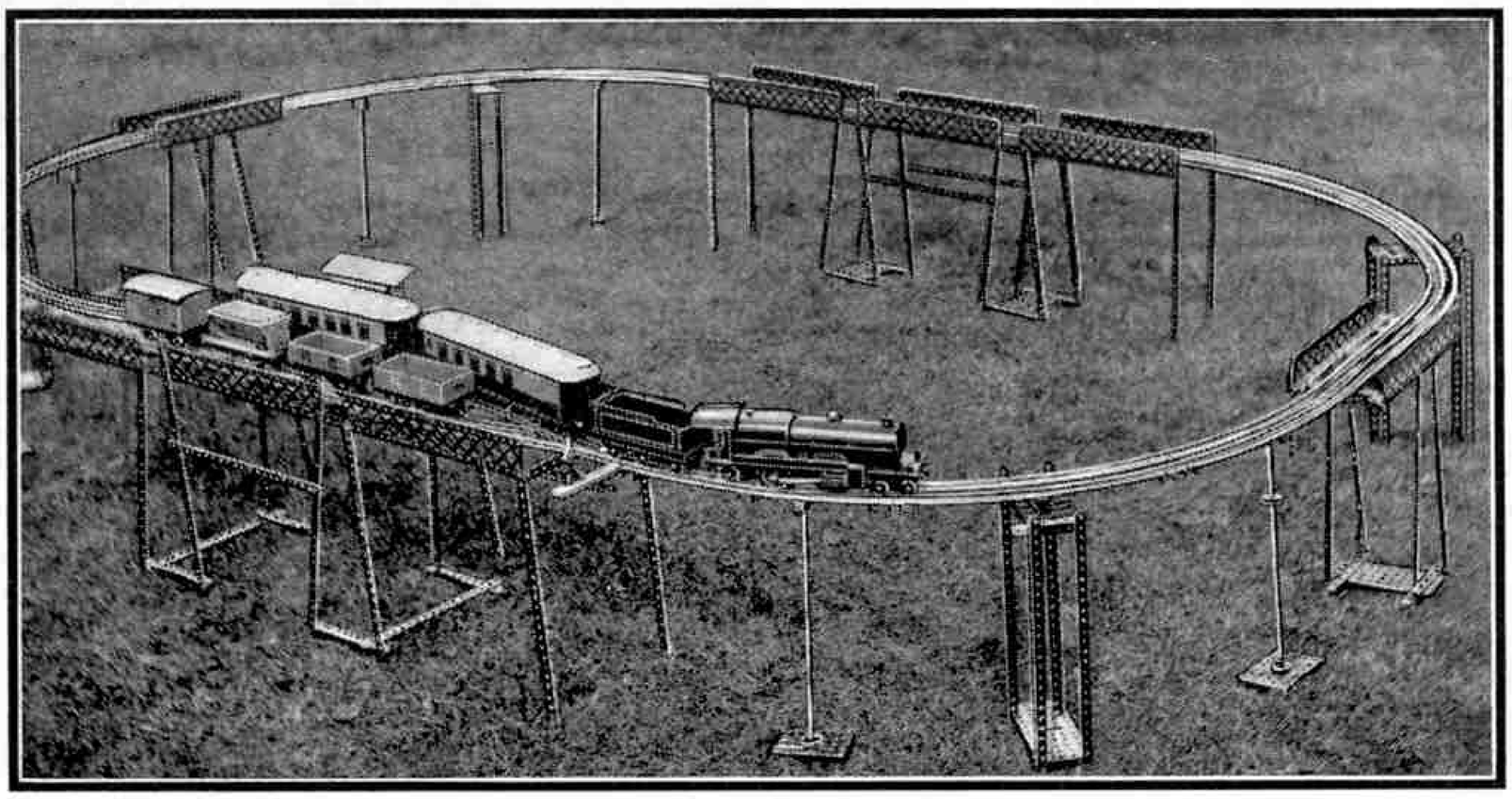
The compact system belonging to A. Jenkins of Keswick, laid entirely on a baseboard. For this photograph we are indebted to G. P. Abraham Ltd., Keswick.

If the garden contains a fair-sized stretch of level lawn, this immediately suggests itself as a suitable site for the layout. As a matter of fact, however, a lawn is by no means an ideal situation unless the grass is cut extremely short. It is of little use trying to lay a track on grass that is at all long, for not only is it impossible to arrange the rails in a level position, but also the locomotives, in addition to their normal duties, are apt to attempt to operate as lawn mowers! If the grass is as short as that of a bowling green, a lawn provides good fun in making it possible to arrange a layout on a much larger scale than can be accommodated indoors. The various buildings and accessories connected with the line then have a very effective appearance, and of course the farmyard animals of Modelled Miniatures No. 2 are in their element!

Failing a suitable lawn, the track may be laid down on any level path or tiled walk. Here a very long single

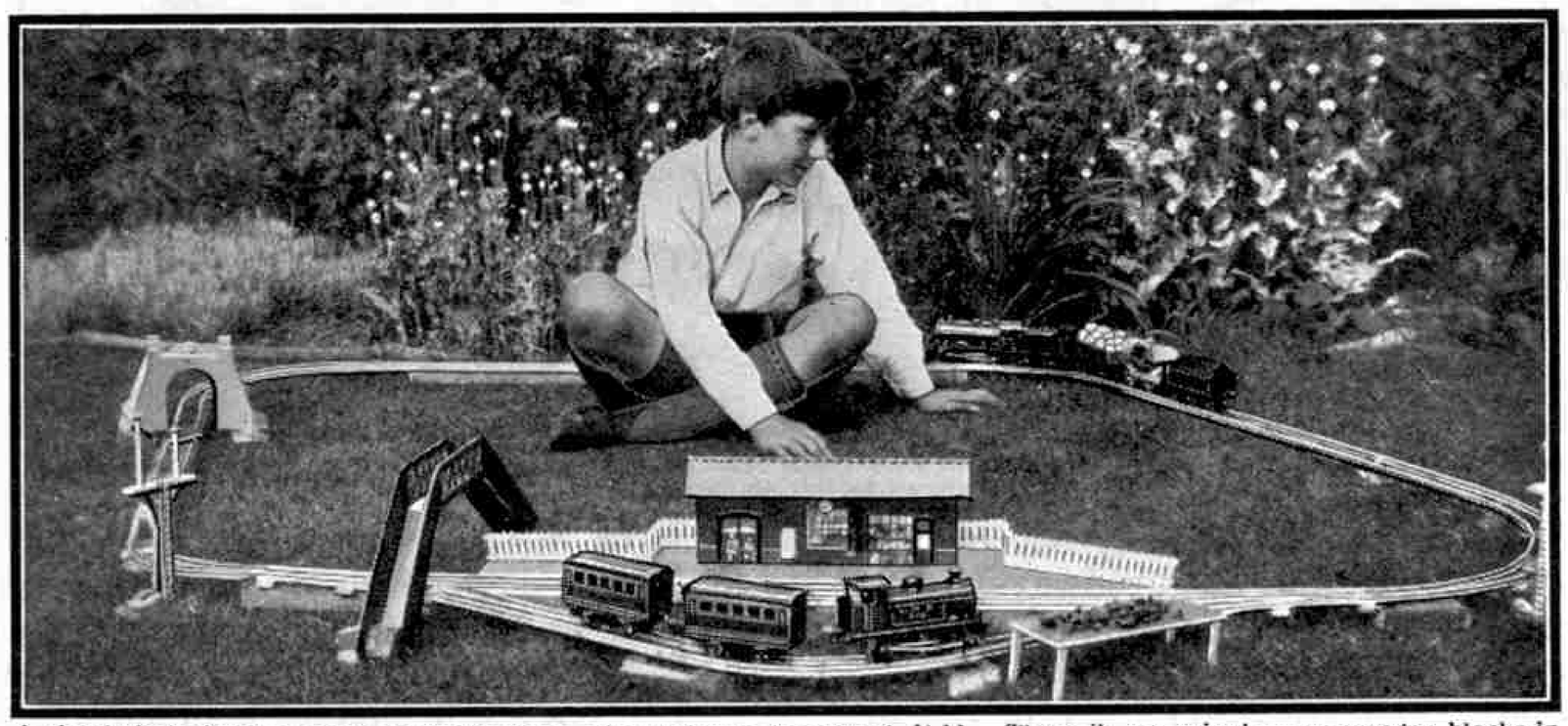
line run is particularly effective, especially if matters can be arranged so that at certain points the trains disappear momentarily behind bushes or other obstacles.

Whether the lawn or a path be utilised, the operations of laying out the track and accessories, and subsequently of removing them, take a great deal of time, especially if the work has to be done single-handed. This disadvantage has led many readers to adopt a scheme that we have often recommended, namely, to fasten the rails to suitable wood baseboards arranged in sections. The form of the sections will depend on the layout adopted. Where the rails alone are fitted to such a foundation, and different formations are experimented with, complete sections of all straight rails might be six rails in length as a convenient unit. The corresponding curved sections might each consist of three curves of 2 ft. radius, forming a quarter of a circle. Points may be included in either the straight or the curved sections, according to the manner in which they are normally used in various layouts.



An interesting method of raising a layout used by H. Smith of Windsor. The scheme may be applied indoors, but is particularly useful in the garden as any uneven surface may be allowed for.

The advantage of this arrangement is of course that, instead of a large number of individual rails and points having to be handled separately, there are only a few sections to be dealt with as complete units. Many H.R.C. members use this sectional baseboard system for their indoor railways, and in such cases of course the transferring of the layout to the garden is a simple matter.



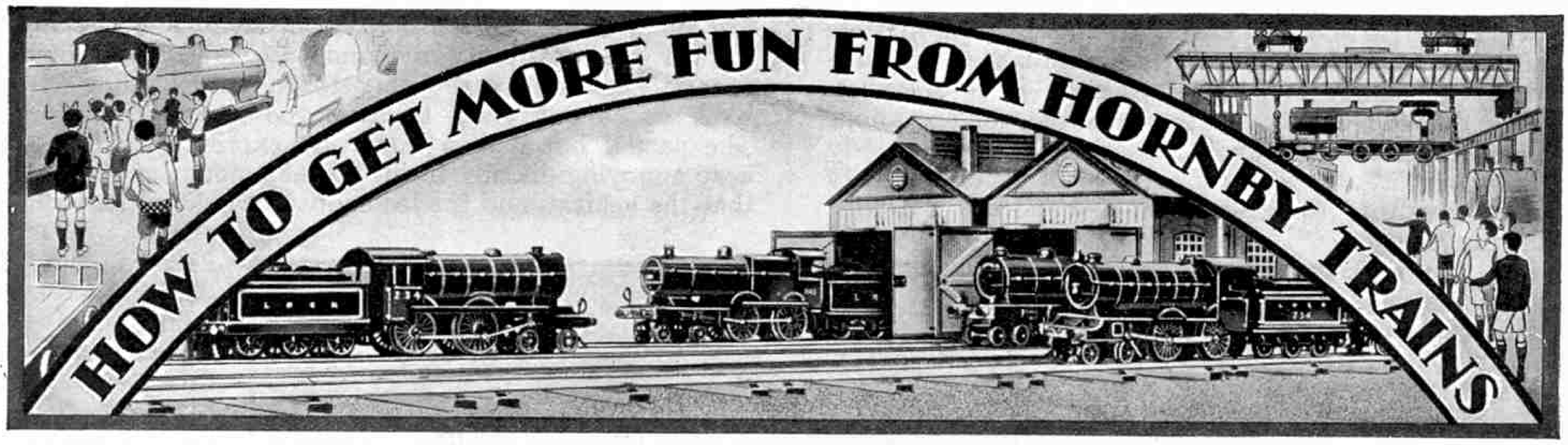
A simple but effective layout operated by M. Richardson of Wanstead, E.11. The rails are raised up on wooden blocks in order to clear the grass.

Occasionally it is possible to arrange for part of an outdoor layout to cross a piece of ground that is not in cultivation. This adds greatly to the attractiveness of a railway, for various features such as cuttings, embankments and tunnels may be incorporated. If the surface soil is not rough enough to satisfy the model railway engineer, he may quickly bring the ground to his liking by means of a little spade work. If a gentle depression is in the way of the line, an embankment must be formed, the track baseboard being laid on top of the earth bank. Again, a gradual hump on the surface will require a cutting to preserve the level of the line. When either banks or cuttings are being formed the possibility of miniature landslips should not be neglected, care being taken not to allow the bank or cutting sides to have too steep an incline. The partial burial of a miniature express would be a very annoying disaster owing to the amount of cleaning that the vehicles and the locomotives would require as a result, apart from any damage they might receive.

Miniature tunnels excavated through ordinary earth are not usually a success, owing to the frequent collapse of the bore. On the other hand if a suitable lining is available, such as a good-sized drain pipe, quite a good tunnel can be made up by heaping earth above the pipe to represent the hill through which the tunnel is driven. Alternatively a wooden framework with tunnel mouths at each end may be used, the soil being heaped above it as before.

The scheme of attaching the rails to baseboards is carried still further by some enthusiasts, the whole layout, including stations and all accessories, being arranged permanently upon a wooden foundation. The number of the sections will depend upon the extent and form of the line, and upon the requirements of storage when out of use. One of our illustrations shows a good example of a layout of this kind, which of course may be used indoors or outdoors as required. All the parts are kept from contact with the ground, and small items are not likely to get lost. These features have made the arrangement a popular one among our readers.

A novel scheme is shown in another of our photographs, where a layout operated in the garden is raised up from the ground to a convenient height for handling on supports made of Meccano parts. The length of the grass and any differences in ground level have no effect, difficulties in the latter direction being readily adjusted by the height of the various trestles and towers shown in the illustration. This arrangement may also be applied indoors instead of erecting a raised baseboard to accommodate the line.

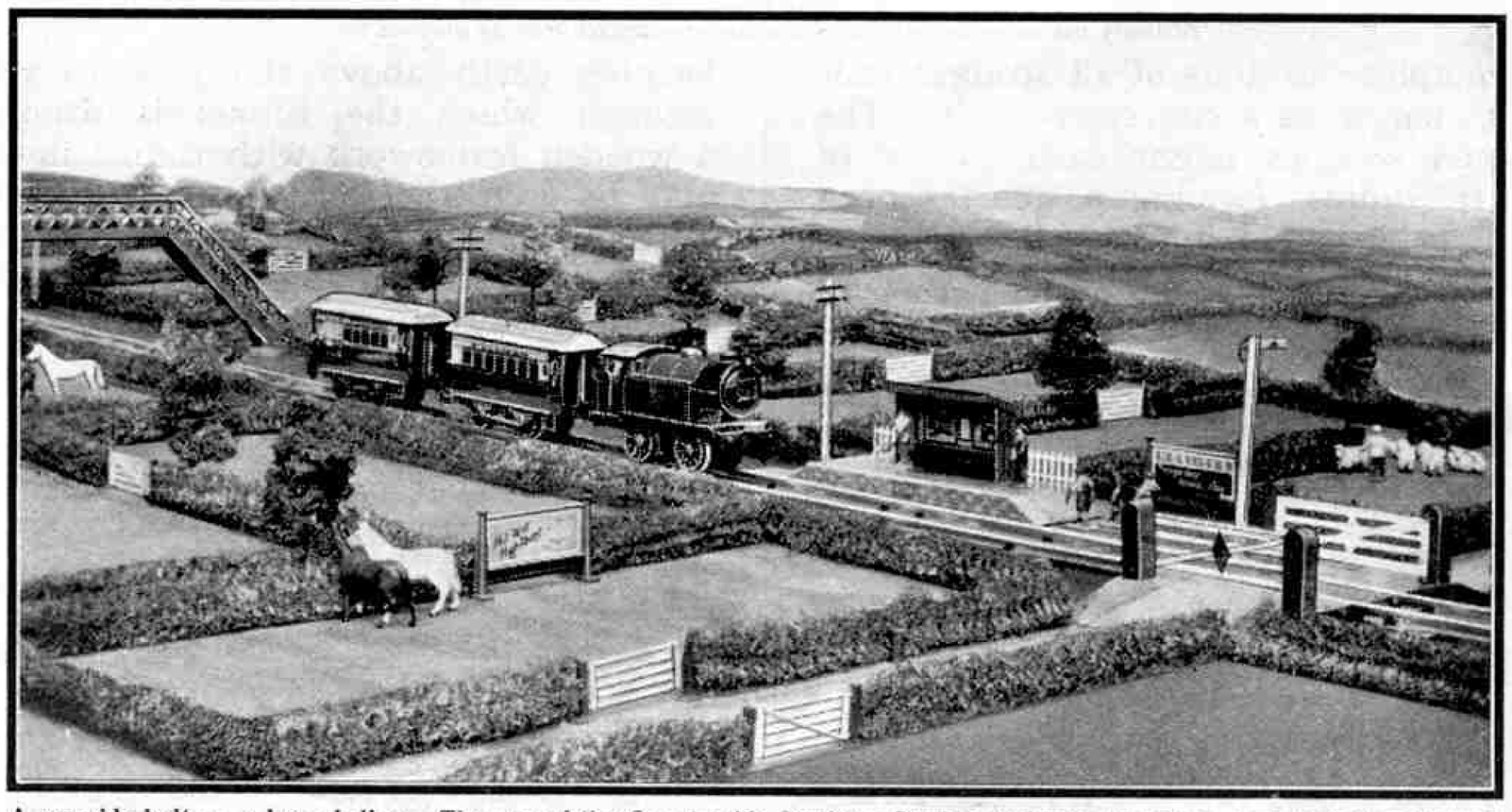


LVI.—BRANCH AND LIGHT RAILWAYS

IT is probably true to say that the majority of model railway enthusiasts devote most of their attention to the reproduction of the outstanding features of main line express passenger train working. This is of course natural, for there is a great fascination in running "Boat Expresses," "Flyers" and "Night Mails." In consequence branch line working is apt to be regarded as less interesting, and therefore is often neglected.

No doubt most layouts incorporate one or more branch lines, but it is seldom that any attempt is made to develop and operate these in a systematic manner. Indeed a branch line is often laid down purely for the purpose of filling up some odd space that is left after the main line plan has been decided. This is a pity, for splendid fun is to be obtained from the regular operation of branch lines, either as part of a main line scheme, or as independent units laid out on the plan of what are generally described as light railways. Such railways are sometimes laid to a narrower gauge than the British standard 4 ft. 8½ in., and special locomotives and rolling stock are then necessary. In miniature, however, in order to employ standard Hornby components it is necessary to suppose that the light railway is of the ordinary gauge, but laid and equipped in a lighter and simpler manner than a main line track. Good examples of this form of construction that occur to mind are the Easingwold Railway in Yorkshire, the East Kent Railway, and the Kent and East Sussex line. The simple nature of such a line, either branch or light railway, allows its chief features to be reproduced very easily. This fact, and the novel character of many of the operating methods, form good reasons for the modelling of systems of this kind.

As regards a layout, any main line plan of reasonable size may incorporate a branch line where the space available is sufficiently extensive to allow of this. The junction where the branch joins the main track need not be elaborate, a bay platform, where such a feature is possible, being provided for the accommodation of the branch train. One of our photographs shows a useful arrangement, a length of Hornby Passenger Platform without the fencing being used to extend the standard Station platform in the well-known manner, and being duly completed by a sloping ramp. The length of the branch line train naturally has some bearing on the extent of the bay platform, but as the smallest locomotives and rolling stock no doubt will be used for branch traffic, matters are easily adjusted.



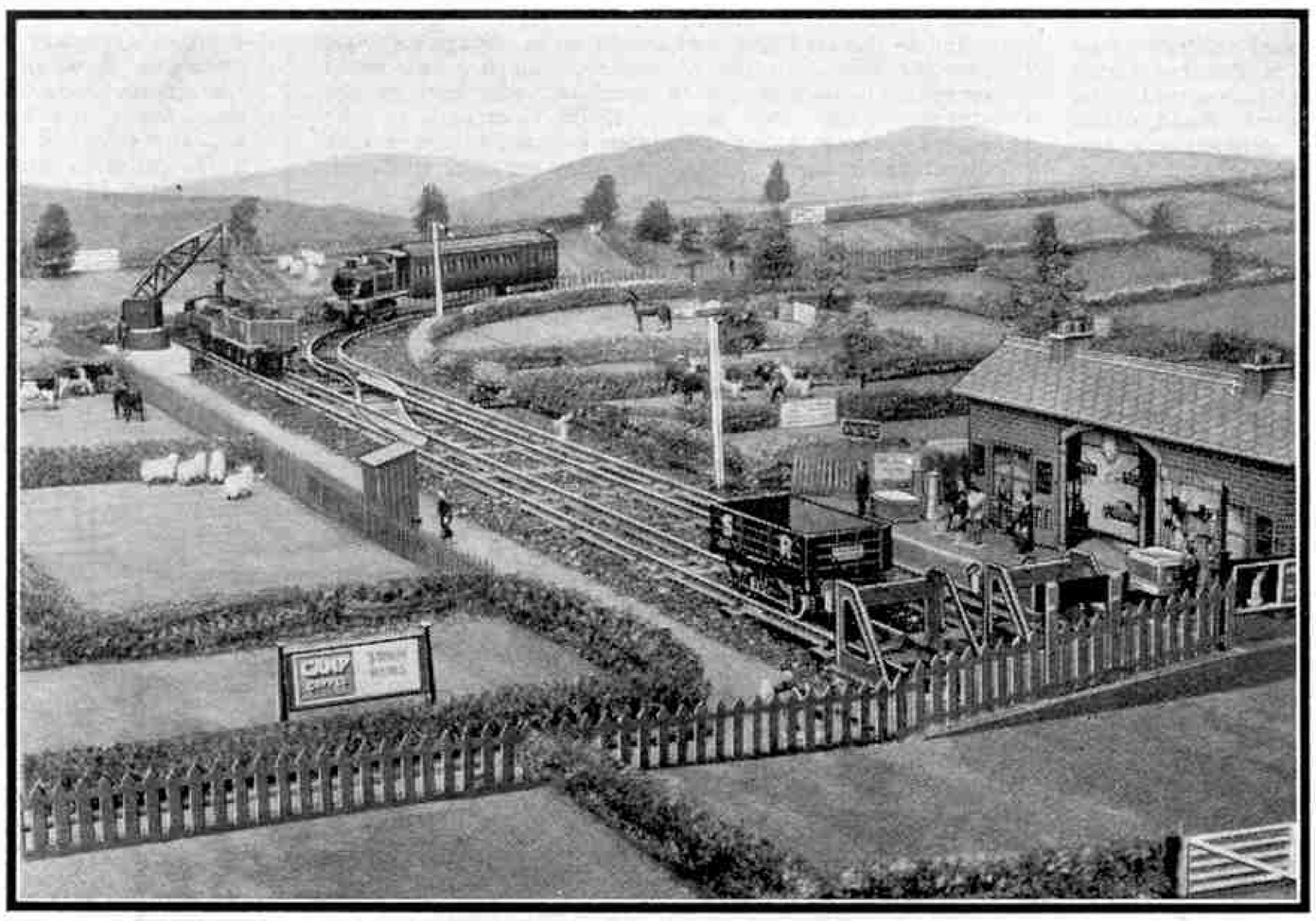
A wayside halt on a branch line. The use of the Countryside Sections, Station and Level Crossing in conjunction is well shown in this photograph.

Some readers with limited space at their disposal, but with the desire to incorporate full detail, may prefer to confine their attention to the branch or light railway alone. Thus the main line is left to the imagination, or merely allowed to serve the junction station and then conveniently disappear from view into a tunnel, cutting, or behind some suitable feature of the landscape. This scheme allows a branch to be laid out in full from end to end, and enables a miniature railway owner to obtain some very realistic effects in an easy manner.

Where the length of the line permits, a passing station, or rather a "halt," may be arranged, and one of our illustrations shows a simple yet realistic arrangement of such a roadside platform. The Wayside Station of the M Station Set is arranged close to the roadway, which the line crosses by means of a Level Crossing No. 1. As traffic would be light in such a rural situation, the train might be arranged to call there only conditionally, a stop to pick up being indicated to the driver by a "home" signal at "danger," as in the photograph. The line might be without signals otherwise, except at the junction station, and possibly at the branch terminal.

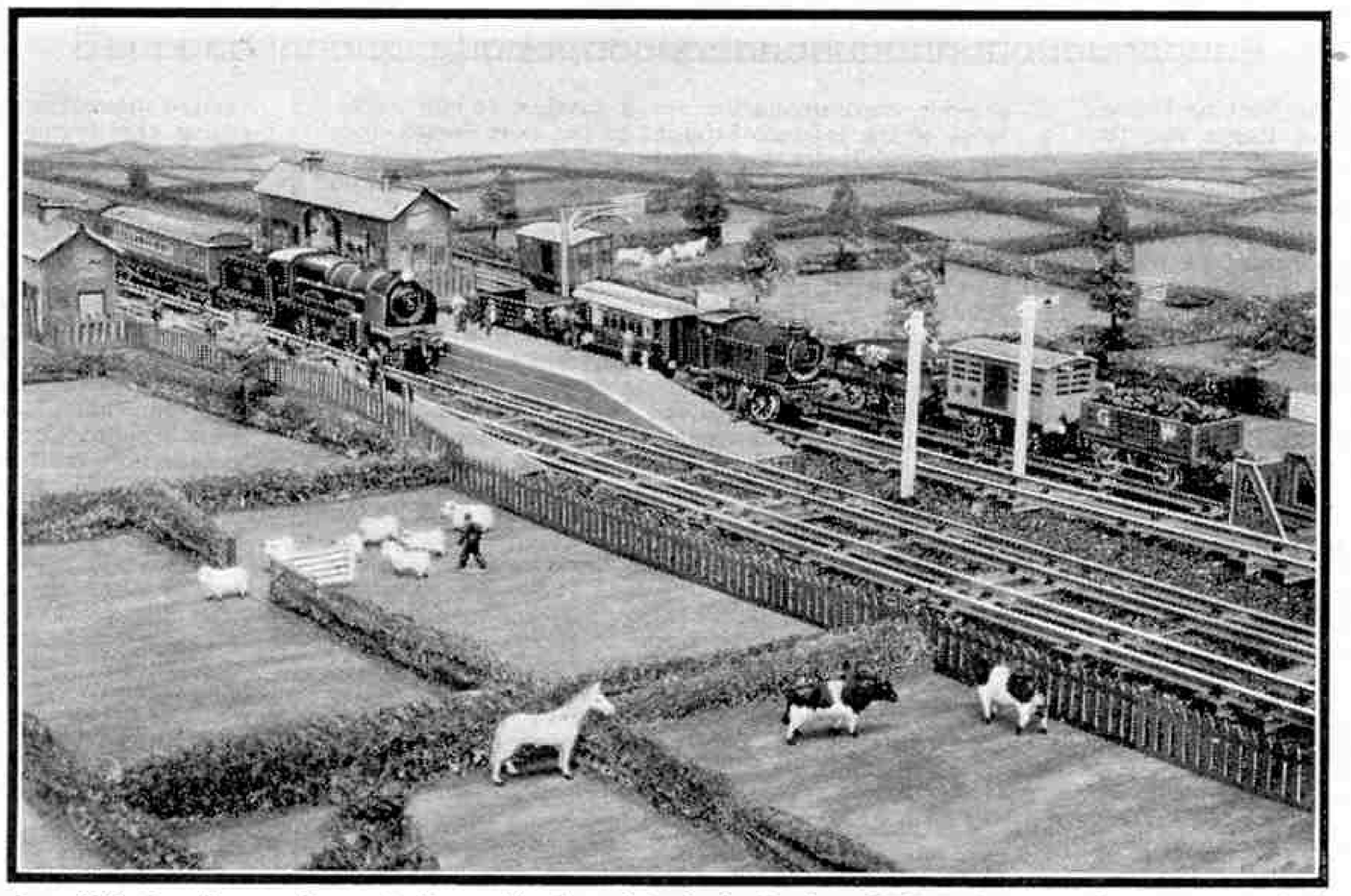
At the branch terminal on a small line the M Station

would be sufficient, but for interesting traffic working on a larger scale the standard Hornby Station is desirable, and also some accommodation for any goods required to be handled. Thus in the illustration of a country branch terminus the No. 2 Station is employed, and with one ramp arranged at right-angles to the line at the buffer stop end, a very effective little terminus is represented. A single goods siding, connected to the platform line by crossover points and served by a Platform Crane, allows loads of reasonable size to be dealt with. The sloping ramp at the buffer stop end of the station may be arranged to lead to the road, as in the photograph, and the effective arrangement no doubt will appeal to many readers. Signals to give permission for arrival and departure may be used. A cabin would hardly be necessary, and the signals may be assumed to be operated, as sometimes occurs in actual practice, from the station building itself, a porter signalman being employed for the purpose of working them.



An effective branch line terminus. The Station is arranged as suggested in this article, and a siding and Platform Crane are provided for goods traffic.

A branch line track will almost invariably be single, though sidings may be arranged to suit the requirements of local operating conditions where space permits. Authority to be on such a line is given by the staff or tablet handed to the driver by the signalman at the junction, and for completeness of effect a miniature staff or tablet—a Meccano 1" Axle Rod or ½" Pulley—may be carried on the engine. Branch lines are frequently worked by "one engine in steam," but the staff or tablet is carried according to regulations.



A realistic junction on the main line. The branch train in the bay platform has a goods wagon attached at the rear, such "mixed" formations being found when traffic is light.

The problem of train operation, locomotives and rolling stock is an interesting one. In actual practice it is often the custom for old coaching stock and more or less obsolete locomotives to be retained in service for branch work, although this tendency is not now so marked as in former days. However, on a Hornby railway suitable employment may be found on an extensive line for coaches and a locomotive that have seen their best days, but are still fit to potter up and down the branch. Thus the now obsolete "Zulu," and other small tank engines with several years' good service behind them, may be given a new lease of life on such work on trains of any suitable rolling stock. The employment of up-to-date items has much to commend it, however, as the smartness of the equipment will give indication of efficient service, and thus will help against any "road competition" that may be supposed to exist in miniature!

One way of dealing with branch traffic is to employ a set train of No. 1 Coaches. These make quite a respectable branch train, and as they are four-wheelers they can take the abrupt twists and turns, often of 1 ft. radius curves, that space may make necessary in order to obtain the required distance for a reasonable length of run. On certain branches, and more particularly on light railways, it is the practice to employ coaches more of the tramway type, having a centre corridor, so that tickets may be issued by a "conductor guard" on the run. This enables the station staff to be cut down which is desirable where traffic is particularly light. This centre corridor characteristic may be obtained by using the smaller Pullmans available in the Series, or even No. 1 vehicles of this type that may have been relegated to less important work. Their smart appearance is attractive, and a No. 1 Composite vehicle is useful in having guards and luggage accommodation, so that a very complete effect is given by its use.

Motor trains of the "push and pull" variety are much favoured by the G.W.R. To imitate their capacious passenger stock a Hornby No. 2 Pullman may well be employed and, with an M3 Tank, will make a very useful unit for branch work, though 2 ft. radius curves are necessary for the running of a bogie vehicle of the kind referred to. For motor train working the engine in actual practice runs normally in the forward direction, but for backward

(*Continued on page 470*)

A Power Station in a Dock—(*Cont. from page 421*)

building, on the ground floor of which are installed the main circuit breakers. Each of these switches has a rupturing capacity of 1,500,000 KVA at 33,000 volts, and weighs, complete with oil, 9 tons. The circuit breakers are operated from the push buttons in the Control Room by means of direct current solenoids.

The outgoing cables from the feeder switches pass into the cable tunnel. This tunnel is situated under the Switch House, and runs from the Station under the Overhead Railway and into Regent Road, thus avoiding the necessity of surface excavations and consequent disturbance of the Dock railway system whenever it is desired to add to the number of the cables leaving the Station. The tunnel is of reinforced concrete construction, and for the whole of its length under the Switch House is divided longitudinally by a concrete wall. On each of the four wall surfaces thus available are ferro-concrete racks that carry the cables.

An interesting problem arose during the design of this tunnel. In passing from the Corporation boundary to the main road it was necessary to tunnel under the railway lines of the Mersey Docks and Harbour Board and the structure of the Overhead Railway without interfering with traffic, and in order to reduce the earth disturbance to a minimum it was decided to reduce the overall width of the tunnel as much as possible. This was done by increasing the tunnel depth and carrying the cable racks on the northern wall of the northern half of the tunnel downward, those on the southern wall of the same tunnel being carried upward and across to the northern wall of the deepened tunnel. A similar procedure was adopted with the cables in the southern half of the double tunnel. The deepened and narrowed portion was of course much more expensive to construct than the tunnel under the Switch House, but in the circumstances the procedure was unavoidable.

In the Control Room are the panels on which are mounted the various measuring and recording instruments and voltage regulators in connection with the main alternators and feeders; and there are distance thermometers that indicate the temperature of different parts of the alternators and transformers. A large wall map shows the network of supply mains fed by the Station, and a plate glass window in the west wall of the room provides a good view of the Turbine House. Communication between the Control Room and the Turbine and Boiler Houses is effected by a telegraph system, and with other parts of the Station and the Head Office through a central telephone exchange.

The Station has now been operating commercially since August 1931, and the results obtained have fully justified the high expectations that were held when the Station was designed. The following figures provide a striking illustration of the improvement that has taken place in the design of generating plant during the last 40 years. In 1893 it was necessary to burn 16.3 lb. of coal in order to produce one unit of electricity in Liverpool; to-day the coal consumption at Clarence Dock Power Station is only 1.11 lb. per unit generated.

The Largest Film Studio—(*Cont. from page 415*)

in hundreds and circulated to the picture houses the next day. The large amount of inflammable material always on hand in a film studio makes an adequate fire-fighting installation imperative, and the Shepherd's Bush studios are equipped with two separate water mains and 3,000 sprinkler heads, so that no matter in what portion of the building a fire may break out it can be attacked effectively without the slightest delay. Connecting up these outlets entailed the laying of six miles of piping.

The studios possess their own power plant, consisting of six generators rated at 1,000 Kw., and two 1,500 Kva. transformers. There is an additional transformer, of 250 Kva., for house lighting. The central switchboards from which the stage lighting is manipulated and controlled are huge affairs and are fed by 15 tons of armoured cable. Ten miles of cables and two miles of steel conduit were used in providing for the ordinary lighting of the studios and of the Corporation's three-storey office building.

The capacity of the studios is so great that often work is in progress on several films at the same time. A few weeks after my visit, for instance, four important films were in course of production simultaneously, and two of them, "*Orders are Orders*" and "*I was a Spy*," necessitated large casts. The studios at Shepherd's Bush, in fact, are busier to-day than at any time in their history, and the rapid growth now taking place in the British film industry is shown by the fact that since these new studios were opened a year ago the staff has been increased from 250 to 750 persons!

Great Ports of the World—(*Cont. from page 429*)

through a series of hatchways in the flat roof in the transit shed to a platform on the first floor below. There the meat is sorted according to its marks on to special meat-handling trolleys that are conveyed by escalators to the reception floor of the cold store, and from there descend by electric lifts through air lock shafts to the cold chambers, where the meat is stored. Four lifts traverse the air locks, and insulated doorways en route provide access to the chambers, ensuring the rapid reception and delivery of produce from and to the storage floor. The empty trolleys ascend to the reception floor, and an escalator working in the reverse direction returns them to the sorting platform alongside the ship.

Tobacco is naturally an important branch of the port's trade, as Bristol is the headquarters of the Imperial Tobacco Company. The quantity of tobacco received annually is close upon 30,000 tons and the Customs duty paid is about £25,000,000. The Port Authority's three bonded warehouses have a total capacity of more than 30,000 casks. Each warehouse consists of reception, sorting and delivery floors, and eight storage floors. Private bonded warehouses provide accommodation for a further 70,000 casks. Most of the tobacco brought to the port comes from the United States, but a feature of the present trade is the increasing proportion of Empire-grown tobacco from Canada, India, Nyasaland and Rhodesia.

The importing of petroleum and its products is steadily increasing, and from a total of 75,793 tons brought to Bristol in 1902 the figure has increased to 700,000 tons. There are three deep-water berths in addition to the coastwise berths at the Royal Edward Dock for the discharge of oil, which is conveyed through pipelines to the depot tanks. Oil berths are also available at Portishead Dock, where there is a special jetty provided with pipeline connections.

Like all other great ports, Bristol has excellent facilities for the repair and reconditioning of ships. The Port Authority have provided the graving dock at the Royal Edward Dock, already mentioned, and this is equipped with a 25-ton electric travelling crane and a steam crane of smaller capacity. It has a capacity of 3,500,000 cu. ft., and the three pumps can empty it in two hours. At the City Docks there are three graving docks built by private enterprise, and the largest of these is 524 ft. long and 52 ft. wide. The equipment provided includes the latest machinery for repair of all classes of vessels.

We are indebted to the courtesy of the Port of Bristol Authority for much of the information contained in this article.

How to Get More Fun—(*Cont. from page 469*)

travelling is driven from what becomes the leading compartment of the coach. Running round of the engine at terminal points is thus avoided, and an elaborate track layout rendered unnecessary.

Another type of unit for branch work that has this useful feature is a rail motor coach, where engine and coach are combined. As the "Sentinel" and "Clayton" types are not yet common enough to justify their inclusion in the Hornby Series, readers may be interested in the older type of rail motor that was very popular some years ago, and a few examples of which are still in use. In this a small locomotive and coach are combined, the former approximating to a small edition of an ordinary tank locomotive, suitably combined with the coach portion to form a complete bogie unit. A very effective reproduction can be made, as shown in one of our illustrations, with Hornby components, and the method was described in the "*M.M.*" for June, 1932.

Famous Air Line Companies—(*Cont. from p. 435*)

Calcutta. After a short sea crossing Akyab is reached, and then from Rangoon the machines fly to Bangkok, Alor Star, Medam, Palembang and Batavia.

Actually the shortest route between Amsterdam and Batavia is only some 7,100 miles in length. This route cannot be followed, however, for various reasons, including high mountains, political difficulties and the weather experienced. Even if all these troubles were overcome it would be necessary, in order to operate the service along this route, for aerodromes to be built, none being yet available. The length of the route actually followed is about 8,825 miles in summer and 9,075 miles in winter, and the journey is at present completed in from 10 to 12 days, and operated once weekly in each direction. It is hoped that by next year new machines will have been introduced to make possible a reduction in the time to six days, and eventually to four days.

The aeroplanes at present employed in operating the route are five of the well-known Fokker F.XVIII and two Fokker F.XII machines. These are triple-engined high wing monoplanes, and it is interesting to note that this type of machine is particularly suitable for service in these regions, as the high wing protects the occupants of the cabin while in the air, and provides shade in which the crew can work when on the ground. Both types are equipped with Pratt and Whitney "Wasp C" engines developing 425 h.p.

A Famous G.W.R. Express

The Fishguard Boat Express, hauled by No. 2933 "Bibury Court," leaving Paddington.

"Adam"—(*Cont. from page 431*)

and that ended our troubles.

Our entry into Eastbourne was almost overwhelming—triumphal is a totally inadequate description! The glow of our candle lamps and the vicious exhaust bark, owing to the silencer being adrift, brought out crowds of people, and strings of cars followed us. We did not know where we had to go, but knowing that Capt. Wylie was staying at the Burlington we made our way there, our frequent stops to enquire the way enabling an ever-increasing crowd to keep up with us. Duly arrived, I dismounted and went in to report that we had not foundered and to get further directions, incidentally correcting an ignominious entry on the results list to the effect that "Adam" was a "non-starter." When I came out again "Adam" was holding a real reception and the whole front was black with people. The police were getting quite excited regarding the normal traffic, so once again we swung the flywheel and so to the garage. A really memorable run had concluded at 9 p.m.

The washing of extremities that were more complete blisters than hands proved to be a further trial, and finally we found that the breakdown lorry had been stowed for the night and we could not get our luggage, and that the hotel, having given us up as lost had disposed of our beds and we should have to share a single! Still, we had intended to get to Eastbourne, and there we were all complete, so what else mattered?

Though so hopelessly late, we were awarded a plaque in recognition of having won through, and I do not think I could value any award more highly—it seems to have been really earned. The following day was the Concours d'Elegance, so we had to be up and doing to remove the stains of travel from "Adam." Apparently we did it well, for out of a very large entry we were awarded the First Prize, the Veteran Car Club Cup, a handsome silver tankard.

So the blisters and other troubles were doubly salved and an extremely proud owner drove "Adam" in the final procession. It had, indeed, been an initiation into Veteranning in many ways. I should be extremely sorry not to have lived any part of it, while my pride in "Adam" and keenness for further competitions were greatly increased.

This article is reproduced by courtesy of the Editor of "Brooklands."

For Canadian Readers

The annual model-building competitions held by Barber and Holdcroft Ltd., of Victoria, B.C., have become widely known and appreciated by Meccano enthusiasts in British Columbia. The 1932-3 contest that closed recently proved the most successful that has yet been held. Not only was a very large entry attracted, but also the models submitted showed a wider range of ideas and a higher general level of constructional excellence than in previous contests.

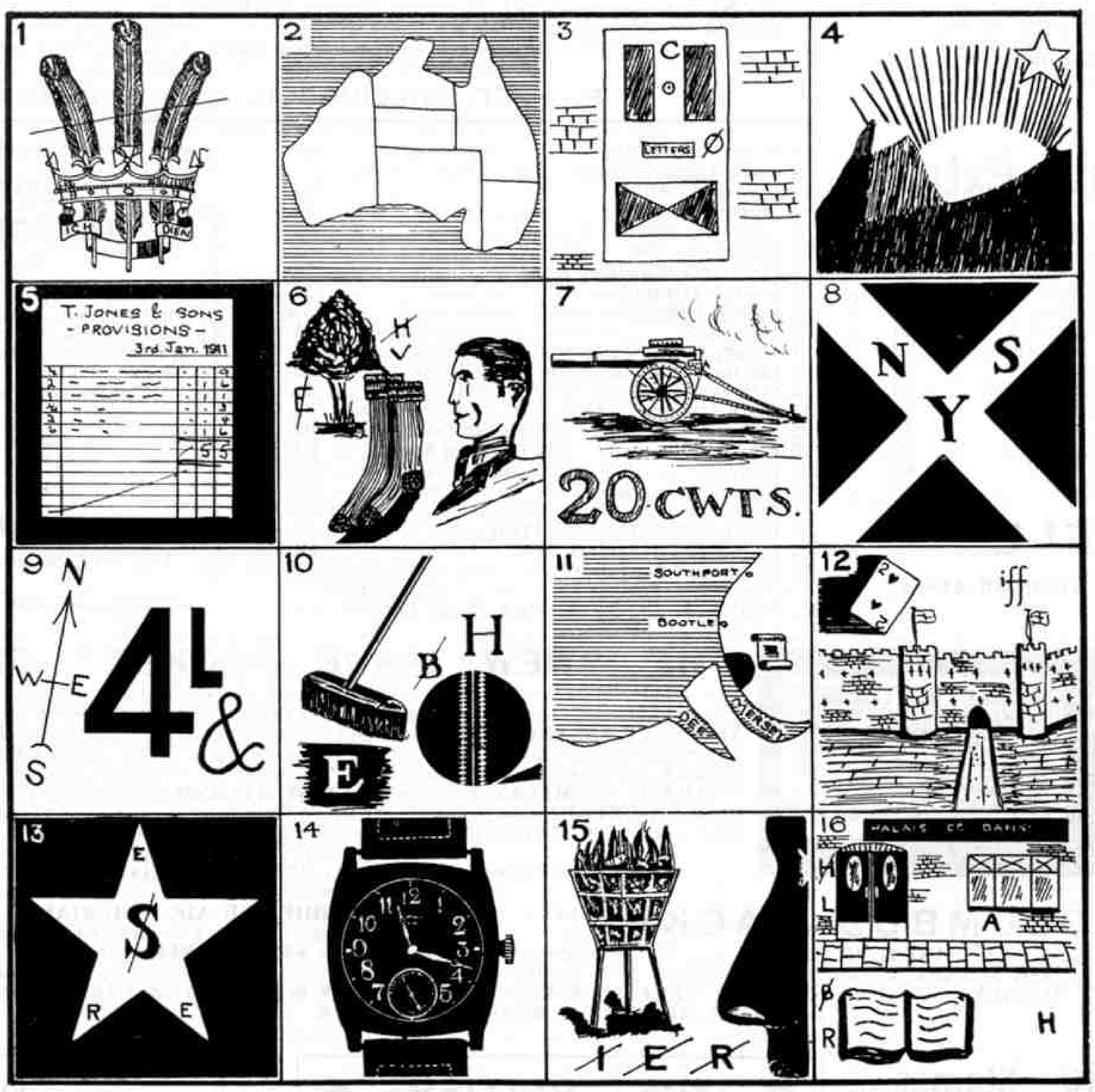
Class 1, over 13 years—First Prize, Roy W. Burgess, Saanich, B.C.; Second, Rex Hundleby, Victoria, B.C.; Third, George P. Kidd, Victoria, B.C.; Consolation Prizes, Richard Gower, Victoria, B.C.; Howard Hipkin, Victoria, B.C. Class 2, over 9, under 13 years—First, William Howell, Oak Bay, B.C.; Second, David Wilkie, Shawinigan Lake, B.C.; Third, Alfred Evans, Colquitz P.O., B.C.; Consolation Prize: Humfrey Gibson, Sidney, B.C. Class 3, under 9 years—First, Norman Shepherd, Victoria, B.C.

H.R.C. COMPETITION PAGE

Competitions appearing on this page are open only to members of the Hornby Railway Company. Envelopes containing entries should have the title of the competition clearly written in the top left-hand corner and should be addressed to the Hornby Railway Company, Binns Road, Liverpool 13. The name, address and membership number of each competitor should appear in clear writing on every sheet of paper used.

A PICTURE PUZZLE CONTEST

This month we give H.R.C. members an opportunity of putting their knowledge of locomotive names to a practical test. Each of the 16 illustrations appearing in the centre of this page shows some object or objects, which, after careful examination, will be found to represent the name of a British locomotive. The problem is to identify the locomotives.



Competitors should first of all study carefully the details in each of the 16 illustrations, and after deciding which locomotive each one represents they should write down its name, number, owning company, and wheel arrangement. The solutions should be numbered to correspond with the illustrations, and no more details should be given than those asked for.

The contest will be divided as usual into two sections—Home and Overseas—and to the senders of the first four winning entries in each section will be awarded prizes consisting of Hornby Train material (or Meccano products, if preferred) to the value of 21/–, 15/–, 10/6 and 5/– respectively. In the case of a tie for any prize, neatness will be the deciding factor. In addition to the main prizes a number of consolation prizes will be awarded to the entries which, while below prize-winning standard, are at the same time deserving of an award.

Envelopes containing entries must be clearly marked "*H.R.C. Picture Puzzle Contest No. 1*" in the top left-hand corner, and posted to reach headquarters at Meccano Ltd., Binns Road, Liverpool 13, on or before the 30th June. The closing date for the Overseas Section is 30th September.

Each competitor must give along with his name and address his H.R.C. Registration number. This is a vital condition to which competitors should pay careful attention, for although it has been repeatedly stated that this number must be given it is often omitted, with the result that the entry has to be disqualified.

Railway Photographic Contest

This is the time of the year when interest in railway photography reaches its highest level. Light conditions are favourable, and most members of the H.R.C. take full advantage of the opportunities provided by holidays to visit places of railway interest. An expensive camera is not necessary as most railway photographs are of stationary subjects, and trains can easily be photographed while they are moving slowly into or out of a station.

In order to encourage members to make the best use of their cameras on excursions of this kind, we are offering this month prizes in a competition in which even beginners in photography may join. The subject of the contest is "*The Most Interesting Railway Photograph.*" Those who enter this competition are asked to forward prints of railway scenes and they may submit as many entries as they wish, but no competitor will be awarded more than one prize. Entries will be judged more on their railway interest than their technical excellence, but in the event of a tie between any two photographs of equal railway interest the photographic merits of the prints will be the deciding factor.

Prizes consisting of Hornby Railway material (or Meccano products, if preferred) to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded to the senders of the four most interesting photographs, and a number of consolation prizes will also be awarded. The competitor's name and full address must be written on the back of each print, together with his H.R.C. membership number. Unsuccessful entries will be returned if a stamped addressed envelope of sufficient size is enclosed.

Envelopes containing entries should be clearly marked "*H.R.C. Railway Photographic Contest,*" and should be posted to reach Meccano Ltd., Binns Road, Liverpool 13, not later than 30th June. The Overseas closing date is 30th September.

COMPETITION RESULTS

March "Popular Photo Contest."—1. H. Millar (26356), Bro'ty Ferry, Scotland. 2. C. G. Gibson (24036), Emyvale, Co. Monaghan, Ireland. 3. D. M. Gilbert (19038), Hull. 4. H. Watson (33806), Harrow. Consolation Prizes: E. H. Frewin (25098), Oldbury, Nr. Birmingham; J. J. Horne (17501), Dorn, Moreton-in-Marsh; L. Parish (18054), Coventry; F. E. Saunders (7989), Folkestone; T. Scriven (31842), Merthyr Tydfil; M. Tolkien (30992), Oxford; C. E. Chown (30438), Slough; C. G. Tildsley (17624), Hanley, Stoke-on-Trent; J. Crawley (30035), Edge Hill, Liverpool; B. Butler (13275), East Sheen, London, S.W.14; C. Eagling (31292), Mortlake, London, S.W.14; G. M. Vickery (29533), Fordingbridge.

March "Breakdown Train Drawing Contest."—1. F. Winding (34236), Clapham, London, S.W.8. 2. G. T. Porter (10259), New Barnet. 3. A. Lucking (3556), Witham. 4. H. J. Murgatroyd (29846), North End, Portsmouth. Consolation Prizes: J. R. Cooper (30490), Swaffham; H. E. G. Flewellen (15057), Swindon; B. C. Boyle (9895), Gilford, Co. Down, Ireland; R. Watson (24608), Small Heath, Birmingham; J. Macken (23826), Bromley; H. Dixon (34165), Huntington; H. Maasch (23994), Hove; J. B. Gowers (32260), North Harrow; J. Cubitt (18854), Colchester; D. Cubitt (18654), Colchester; C. Gardner (32004), Retford; H. Cantrill (23087), Castle Donington.

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Including 10 all different **Greece,** showing head of **Hermes,** Iris, Ship in **Corinth Canal,** Native costumes, the **White Tower** at **Salonica,** Temple at **Theseus, surcharged,** etc., also a fine set of 5 scarce Germany, **surcharged,** for use in **captured Belgium,** and a splendid set of 5 French Colonials (natives, jungle scenes, animals, etc.). I will send this valuable collection **absolutely free** to all stamp collectors sending 2d. postage (abroad 6d. P.O.). Only one Gift to each applicant.

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Marvellous Value.

Every parcel is **Guaranteed Unsorted** and **Unpicked,** and contains stamps from **most parts** of the **World.** Very few English. Many **Good Stamps** are to be found, and there is always the chance of a **Real "Find"** being made. For **sheer value** these **cannot be beaten.**

½ lb.	(about **2,500** stamps)	**2/3** post free	**2/6**
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(Postage abroad extra.)

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122, GLADSTONE ROAD, WIMBLEDON.

THE "NEW ISSUE PACKET" FREE

This wonderful packet will be given **FREE** to all who apply for my famous Approval Sheets and enclose 1½d. postage. It contains **FINE PICTORIAL GABOON** (just issued). **NEW ISSUE ANDORRA,** a fine set of newly issued **CANADA,** including the **OTTAWA** Conference stamp; **U.S.A.** Bi-centenary of Washington, 1932; set of **UNION OF S. AFRICA,** pictorials, including re-issue of 2d., with war memorial added; new issue of **STRAITS** and **MALAY,** 5c. brown; a **FINE ICELAND** pictorial (see illustration); **RUANDA-URUNDI,** new pictorial; **TURKEY,** new head issue, etc. 50 Stamps in all. Have you had my 70-page illustrated booklet, price 1d.? Senders of stamp collectors' names receive an extra set free.

H. C. WATKINS, "M" DEPT., GRANVILLE ROAD, BARNET.

FREE "COLUMBUS PACKET"

This great set of **8 SPANISH PICTORIALS,** unused, showing Columbus's flagship, the **SANTA MARIA,** both fore and aft views, also **AIR STAMPS** (Monastery of La Rabida), 50 other fine stamps, including many Colonials, unused high values, **BRAZIL, TURKEY,** good sets, etc.

SET OF 8 SHIP AND AIR PICTORIALS
(Fine large stamps showing Flagship of Columbus).

FREE TO APPROVAL APPLICANTS WHO SEND 2d. FOR POSTAGE.

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50 DIFF. STAMPS

English £1, 15/- & 10/- Stamps

These three stamps (issued and used for a special Revenue purpose) with seven others, including one nearly **90 YEARS OLD** and other **OLD** English postage stamps **GIVEN AWAY** free of charge to genuine applicants for selections of duplicate stamps on approval.

HENRY TURNER,
110, Barnett Road, Preston, Brighton, Sussex.

6 MINT BRITISH COLONIALS FREE 6

ZANZIBAR, KENYA, TURKS and CAICOS IS., MOROCCO AGENCIES, SOUDAN and CAYMAN IS. Ask for the No. 200 Packet.

EDWARD SANDELL,
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JUNO

It's time you sent for one of my **4-a-PENNY** selections, the best at the price; and once you've seen them, you won't say

JULY.

L. D. MAYNARD,
78, RICHMOND ST., SOUTHEND-ON-SEA.

FREE! Set of New Guinea FREE!

The above free set to all Collectors sending for approvals. A really good class selection sent on approval at bargain prices, containing new issues, pictorials, Air Mails and scarce Colonials.

SEND A POST CARD TO-DAY.

C. H. SHAW (Dept. M.),
95, Christchurch Avenue, Kenton, Harrow.

100 DIFFERENT STAMPS FREE. Send for halfpenny approvals.—Cox, 21, Dennis Mansions, Westcliff.

Three Caymans Centenary Free to genuine approval applicants.—Sanders, Newlands Ave., Southampton.

FREE! 7 GREECE pictorials (1927)

To Genuine Applicants for my "Peak" Approvals.

S. BACKHOUSE, 61, WARNER STREET, DERBY.

THIS CASKET FREE to Stamp Collectors.

STAMP CASKET with Pictorial Coloured Hinged Lid, including Watermark Detector, Perforation Gauge, Stamp Tweezers, Transparent Envelopes, Famous Matlock Mounts and Rare Abyssinia Stamp. Just send 3d. postage (Colonial Stamps accepted) or if 4d. is sent a Powerful Magnifying Glass in Folding Metal Case will be included in Casket.

VICTOR BANCROFT, MATLOCK, ENGLAND.

Boys! Look! ask your Shop FOR "XLCR"—

THE PACKETS THAT ARE HONEST INSIDE.

Every Stamp Guaranteed Genuine: no two stamps alike in any one packet! 20 for 1d. 40 for 2d. 60 for 3d. 125 for 6d. and 24 different 2d packets of separate countries! "XLCR" Stamp Mounts are British Made in my own factory, pure tasteless gum, full size, in transparent envelopes, so that you can see before you buy. 125 for 1d. 300 for 2d. **OFTEN LICKED—NEVER BEATEN!** Be wise—insist on "XLCR" PACKETS and refuse all substitutes which are inferior. Ask your shop, but in case of difficulty drop a line to

THOMAS CLIFFE, COLWYN BAY.

Stamp Gossip

and Notes on New Issues

Serbian "Death Mask" Stamps

Prompted possibly by a reference that appeared in a recent issue of *"Stamp Collecting,"* Stanley Gibbons Ltd. in their advertisement in the May *"M.M."* offered a set of the interesting Serbian "Death Mask" issue. Several readers have written to enquire the explanation of this gruesome description, and as the facts illustrate how readily the stamp album aids the study of history, we reproduce

the 10 para value from this series.

From the early days of the 19th century Serbia had been ruled by the rival Royal Houses of Obrenovitch and Karageorgevitch. In 1889 King Alexander (Obrenovitch V) ascended the throne with Queen Draga. Peter, of the Karageorge House, then became heir to the throne, and when Alexander and his Queen were cruelly assassinated in 1903, it was freely stated that the crime was engineered by Peter's supporters.

That may or may not have been true, but it is evident that the designer of the stamps issued to celebrate Peter's accession had very definite views on the question. The design was to include the portraits of Peter and of Karageorge who had founded Peter's house 100 years earlier. The designer superimposed King Peter's portrait upon that of Karageorge, and ingeniously worked in a death mask portrait of the assassinated Alexander.

The death mask is not readily visible until the stamp is inspected upside down. Then it will be seen that Karageorge's nostril and eyebrow form Alexander's left eye and moustache.

An Unusual Provisional

Ordinary postage stamps overprinted for air mail purposes have been commonplace for many years now, but Newfoundland has created a provisional stamp of unusual interest by reversing the normal order of things and overprinting air stamps for ordinary postal purposes.

To meet a temporary shortage of 15c. stamps the current 15c. air stamp was converted by means of a vertical overprint "L. & S. Post" (Land and Sea Post).

Swaziland's First Issue

There is a certain air of distinction about the first postage stamps of Swaziland, a specimen of which is illustrated here, that will ensure great popularity with collectors in all parts of the world. A single design is employed for each of the 10 values in the series, ½d. to 10/–.

The most interesting point is not in the pictorial features, or in the map of the territory that serves as a background for the figures of value, but in the description of Swaziland as a "Protectorate." Reference to official publications provides no record of this status. It would seem that a strange mistake has been made, and a revised design will be necessary for the next printing.

Another Coincidence

In our April notes we referred to the strange coincidence of the choice of a common theme by the Belgian and Roumanian designers of Anti-Tuberculosis charity stamps.

Even more remarkable is the case of the Falkland Isles issue, illustrated last month, and the issue for St. Pierre and Miquelon, the tiny French North Atlantic colony. These series appeared almost simultaneously, and although the French series contained only four designs, three of them parallel the Falkland designs! As our illustration of the 30c. stamp shows, in production the French stamps are not to be compared with the Falkland Island issue, but the coincidence lends them special interest.

The series includes 22 values, ranging from 1c. to 20 fr. for general postal use, and 11 denominations, 5c. to 3fr., for postage dues. Three designs are used for the general issue, showing a map of the island, a coastal scene and a steam trawler at work. The fourth design, reserved for the postage dues, is quite the best. It shows a Newfoundland dog standing on a group of rocks.

The frames are a striking feature of the designs. Each has a distinctive marine motive. Thus on the map stamp two fishermen with trailing nets flank the central design; on the seascape there is a number of codfish, and on the trawling scene a lively collection of seagulls.

* * *

The Argentine Government have decided not to recognise the Falkland Islands centenary stamps and all letters from the Falklands to the Argentine bearing these stamps will be surcharged. The Argentine Government have long disputed Britain's right to rule the Falklands.

A History of Aviation

Latvia has often been accused of exploiting the stamp collector by the manufacture of unnecessary commemorative and charity issues. The latest emission to raise funds for disabled airmen is likely to prove popular, however, for the designs provide an interesting though brief history of the development of aviation.

The set contains only five values, issued at varying *premia*, in both perforate and imperforate form. The design of the 5 sant, depicting Icarus flying to the Sun, is specially interesting. Icarus, Greek legends tell us, was imprisoned with his father Daedalus on the island of Crete. Daedalus fashioned a set of wax-coated wings into which feathers were stuck, and with the aid of these wings he and Icarus made good their escape by flying across the sea to Italy. Subsequently Icarus stole the wings and flew alone in an attempt to reach the Sun. He ventured too near, the wax melted, and he fell headlong into the sea.

The 10s. value shows a portrait of Leonardo da Vinci, the great Italian artist-philosopher, who was the first to study the science of flight. The 15s. stamp, illustrated here, shows the hydrogen-filled balloon constructed by the physicist Charles, in 1783. Charles had witnessed the 1½-mile flight of Montgolfier's balloon filled with heated air, and at once recognised the greater possibilities of hydrogen.

The 20s. stamp brings us to more modern times. It shows the famous first flight of the Wright biplane in 1903. The high value of the series, the 25s., also illustrated here, provides a link with the famous Blériot monoplane that made the first crossing of the English Channel in 1909.

* * * *

In April Holland commemorated the fourth centenary of the birth of Prince William of Orange, and a special set of stamps was issued bearing reproductions of famous portraits of the Prince. The set contains four values, 1½, 5, 6 and 12½c., and will remain valid throughout the year.

We thank Stanley Gibbons Ltd. for their courtesy in loaning the stamps from which the illustrations for our stamp pages have been made.

KING'S HEADS, Colonial and Foreign Duplicates for disposal. One Farthing per stamp. Send postcard for trial.–Philatelist, 32, Josephine Avenue, Brixton, S.W.2

5 Montenegro Pictorials Free to all applicants for approvals enclosing 1½d. postage.—Launchbury, Begbroke, Oxford.

DO YOU COLLECT Fine Used British Colonials? Then ask to see my collection of 600 different at ½d. each Stamp, the best value at the lowest cost. Sent on approval on request. A good selection at 1d. each and upwards if desired.
BICKERS, Elveden, Lordswood Avenue, Southampton.

GOLD COAST PKT. FREE. This wonderful **packet** contains **70** all diff. **Superior** stamps, including **Gold Coast, Nigeria, 3 Irish, Canada, New Zealand,** set **7 Japan, 2 U.S.A.** (Bi-Centenary), also a **scarce Hungary Official (Cat. 4d.).** All **FREE**!! Just send ½d postage requesting the **cheapest** approvals ever offered.
Pucka Stamp Co. (Dept. M), **27, Normandy Ave., Barnet.**

NOT A FREE GIFT. Send me 4d., ask for selection from 4 a 1d. (30 for 6d.), and I will send you new Pictorial Falkland, Papua, Cayman Centy., New Guinea (Air), Manchukuo, Trans-Jordan, Angola, Monaco, and 25 different Colonial and Foreign. Without Approvals, 6d.—J. R. Morris, 9, Audley Road, Folkstone, Kent.

200 diff. British Cols. **2/6** 1,000 diff. stamps **2/6**
125 diff. 1d. Plate Nos. **2/6** 2,000 mixed ,, **2/6**
No Apps. With each of the above packets I give
500 DIFFERENT STAMPS FREE
N. LOSEBY, 39, Carolgate, RETFORD, Notts.

"DIAMONDS"

MANY RARE STAMPS have been found by purchasers of **The "DIAMOND" Packet,** which contains approx. **1,000 UNSORTED STAMPS** from Convents abroad.
1 pkt. 1/3. 3 pkts. 3/6. 5 pkts. 5/6.
All post free. (Abroad 3d. per pkt. extra.)
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(Dept. "L"), 68, TURNPIKE LANE, LONDON, N.8.

1000 DIFFERENT STAMPS 1000
ON APPROVAL
from which you may select any 100 for 3/–. This selection is not made up of the thousand commonest stamps, but contains specimens priced by Stanley Gibbons up to 1/– each. For 3/– you have the opportunity of choosing 100 stamps of the catalogue value of 20/– or more.
H. HARDY,
39, Rosebery Gardens, Hornsey, London, N.8.

VATICAN PACKET FREE!

A fine packet of all different stamps containing a fine **Vatican State** unused, **Jamaica 2/–, Crete, Paraquay, Brit. Honduras, Kouang-Tcheou, Turkey, Cameroon, Brit. Guiana, Prussia Official, Ceylon.** Free to all asking to see my famous approval sheets and **enclosing 2d. for postage (abroad 6d. P.O.).** Albums from 1/4 upwards.
S. HAMMOND, CHESHAM FIELDS, BURY, LANCS.

THE FIRST STAMP EVER ISSUED
was the British 1840 Penny Black. Against a P.O. **1/9** we will send you a genuine postally-used copy of this interesting stamp (cat. 6/–); for a further **5/–** you may have a copy of its companion stamp, the 1840 2d. Blue (cat. 20/–). Another "classic" which every Collector should have is the **Cape of Good Hope** 4d. blue **Triangular** (cat. 15/–), and a nice copy will be supplied at **5/–.** Superb approvals of any country against satisfactory English references or a deposit. **Full Lists Free.**
NORRIS & CO. (Dept. M), Norwood, London, S.E.19.

FREE—TROPICAL PICTURE PACKET
Over **80** different—mostly UNUSED—from all parts of the world, including **Chinese Temple, Statue of Brahma, Tower of Rabat, Map,** several **Native Types, Archer, Musician, Tropical Views and Scenes, Fruit Gatherer, Palm Gatherer, Native Industry (Mill)** and **Settlement, Merchant crossing Desert, Oxen, Panthers, Native Wells,** etc., etc., including several surcharges. A delightful addition to any collection.
FREE to all **GENUINE APPROVAL CUSTOMERS** sending postage (abroad 4d.).
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A GREAT SUCCESS!

My **Bargain Packets** at **1/–, 2/6 and 5/–** each have proved a great success, many collectors sending repeat orders. I have decided to continue this offer, so seize this opportunity to enrich your collection for a small outlay. In addition, I have introduced a special **JUNIOR PACKET,** price **6d.** only, containing **40** diff. high-grade stamps. State if you like **Quality** or **Quantity.** Orders for **1/–** or under postage **extra,** please.
W. A. JONES, 39, NEVILLE ROAD, CROYDON.

NOW READY
OUR 1933 PRICE LIST OF SETS
3333 sets covering the world from Abyssinia to Zululand are quoted at prices ranging from 1d. to £1.
Price 6d. Post Free.
ERRINGTON & MARTIN (Dept. 221),
SOUTH HACKNEY, LONDON, E.9.
Established 1880.

SCARCE PICCARD BALLOON & AERO PACKET FREE!!

Over **60** Different Stamps, **Brazil** (Aeroplane), **Morocco** (Biplane), **Roumania Aviation Fund** (Monoplane over Mountains). Over 30 Obsolete High Value Stamps, and a **Complete Set of Airmails** issued in 1919. Also **The Piccard Commemorative** (see illustration), which will soon be scarce. Included also are **Zoo** and Commemorative Stamps, **Maps,** Sowers, Reapers and Blacksmiths. **ALL FREE!** Just enclose 2d. postage requesting Approvals.
SHOWELL BROS. (M.M.21),
42, VANBRUGH HILL, LONDON, S.E.3.

Model Used in Filming "Rome Express"

In the article in the April "*M.M.*" describing how "*Rome Express*" was filmed, we illustrated on page 259 the model train hauled by a small-scale "Pacific" locomotive that was used for certain "shots." Readers will be interested to hear that this model was constructed by Bonds O' Euston Road Ltd., London, the well-known firm of model engineers. The only particulars given to them consisted of a postcard illustration of the real train, but in spite of this the model was made in three weeks.

The "Skybird League"

The "Skybird" scale-model aeroplanes introduced by A. J. Holladay & Co. Ltd., nearly a year ago, achieved immediate popularity, and have grown in favour with each addition to the range of types available.

The latest development is the formation of a "Skybird League" to guide the activities of the "Skybird" model clubs that have been formed in various parts of the country. The "*Meccano Magazine*," along with "*Popular Flying*," has been selected to carry the official notes of the "Skybird League," and from time to time announcements of interest to members will appear in our columns. Full details of the League, its objects, and its badge can be obtained from "Skybird League" Headquarters, 3, Aldermanbury Avenue, London, E.C.2.

"Inexpensive Photography"

"*Inexpensive Photography*" is the attractive title of a new booklet issued by Burroughs Wellcome & Co. A large proportion of the expense of the photographic hobby arises from material wasted through mistakes in exposure and development, and this booklet shows in an interesting manner how waste of this kind can be almost entirely avoided, even by the beginner. The methods described are simple and interesting, and if followed with reasonable care will ensure the regular production of excellent negatives and prints with the minimum expenditure of time as well as money. An important section of the booklet deals with the production of realistic colour effects by the use of "Tabloid" Toners and "Soloid" Stains. The booklet is attractively produced, and contains reproductions in colour and monochrome from actual photographs. These illustrations are of special interest as examples of the striking results that can be obtained by suiting the colour to the subject. Two of the most effective are a seascape toned blue and a courtyard scene in Cadiz in which brilliant sunshine is strongly suggested by the use of a yellow stain.

A copy of "*Inexpensive Photography*" will be sent post free to any reader who applies, mentioning the "*M.M.*," to Burroughs Wellcome & Co., G.P.O. Box No. 213A, London.

A Unique Motor Cycle—(*Continued from p. 453*)

To enter the Contest it is only necessary to send a photograph or clear drawing of the model together with a short description of the main constructional features. Actual models must not be sent. The age, name and address of the competitor must be written clearly on the back of all photographs or sheets of descriptive matter submitted. Envelopes containing entries must be addressed "Entire Range" Contest, Meccano Ltd., Binns Road, Liverpool 13.

The entries for Home readers must reach Headquarters not later than 31st July, 1933, and those from Overseas readers not later than 30th September, 1933.

It is not difficult to obtain a good photograph of a model provided simple precautions are taken. As the models will be assembled from parts of various colours a plain sheet of white paper will make the most suitable background.

Competitors should note that they need not necessarily be owners of the complete Meccano Constructor Sets in order to enter the Contest, as all the parts of which these sets are composed may be obtained separately from any Meccano dealer.

What is Missing?

There is an advertisement missing from our advertising pages this month. It has been a regular feature in every issue for nearly ten years! Which is it?

To the first reader who answers this question correctly we will award a copy of the Editor's book "*Engineering for Boys.*" The next dozen correct solutions will be given consolation prizes.

The answer should be written on a post card and addressed to "Missing Advertisement, Meccano Magazine, Binns Road, Liverpool 13." Entries postmarked before 1st June will be disqualified.

BINDING THE "M.M."

There are two methods of binding the "*M.M.*" to preserve back copies from the destruction that inevitably will be theirs should they be handled for any lengthy period without protection. First there is the spring-back binder system, that permits the copies to be inserted or removed from the binding case at will. This is intended primarily as a temporary protection for current copies.

Handsome spring-back cases specially prepared for the "*M.M.*," with the name blocked in gold letters on the front cover, can be obtained from Meccano Limited, Binns Road, Old Swan, Liverpool 13, price 3/– and 4/6 for sizes large enough to hold 6 and 12 copies of current issues respectively.

Permanent binding cases for back numbers of the Magazine can be supplied by Messrs. O. H. Bateman and Co., 23, Hanover Street, Liverpool. These cases are supplied in two sizes (1) for six copies, price 3/6 and (2) for twelve copies, price 5/3, post free in each case. The binding cases are supplied in what is known as "Quarter Basil, full cloth"—that is to say three-quarters of the sides are dark crimson cloth and the back and a quarter of the sides are dark crimson leather as shown above. The case is tastefully embossed in gold with the name "Meccano Magazine," and on the back is the name and volume number.

Binding Six or Twelve Copies

These binding cases are supplied so that readers may have their Magazines bound locally, but where desired, the firm mentioned above will bind Meccano Magazines at a charge of 6/6 for six issues or 8/6 for twelve issues, including the cost of the binding and also return carriage. The covers of the Magazines will be included unless otherwise specified.

Readers desiring to have their Magazines bound need only make a strong parcel of them, include a note of their name and address together with the necessary remittance, and send the parcel direct to Messrs. O. H. Bateman and Co., carriage paid.

Photography Without a Camera

A Century-old Experiment

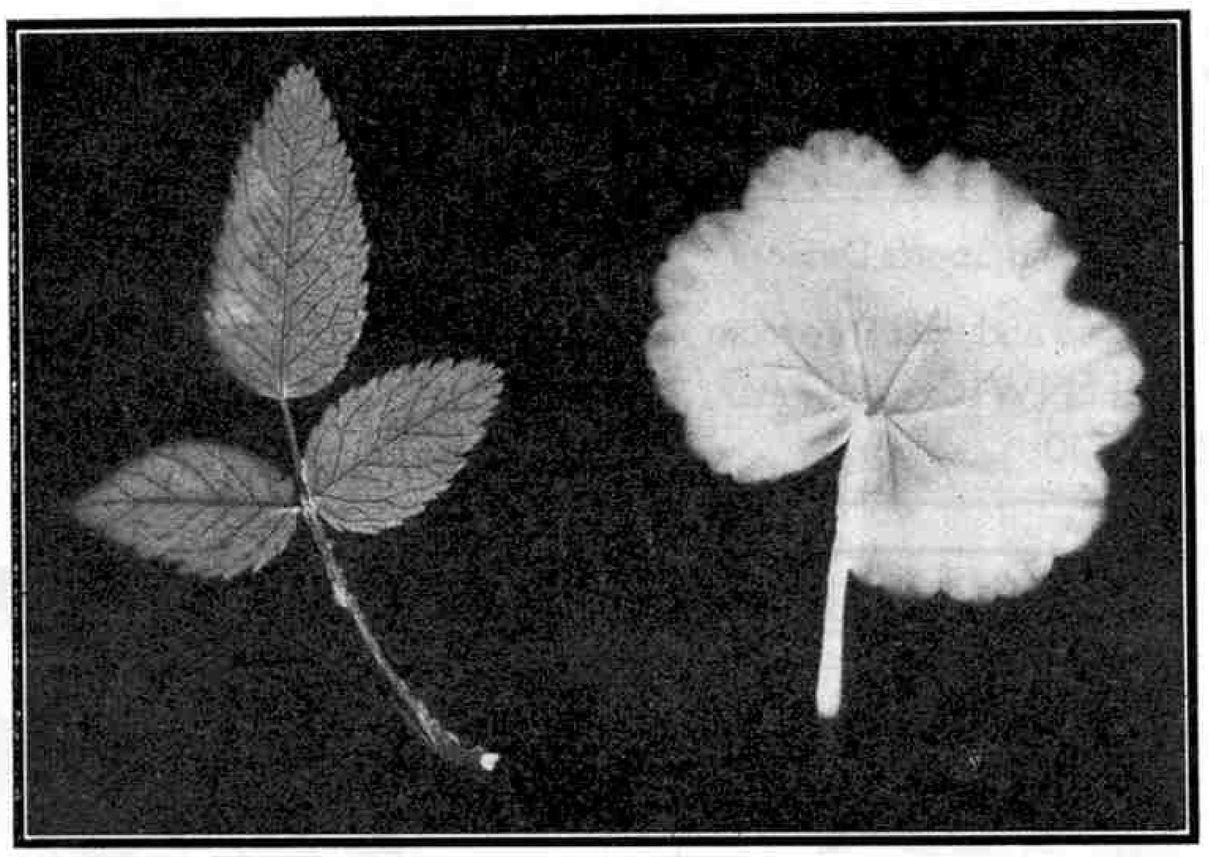
ONE of the simplest and most interesting photographic experiments is that of taking pictures of leaves, ferns or pieces of lace, without the aid of a camera. It is also one of the oldest experiments in photography, as it was discovered by William Henry Fox Talbot, one of the pioneers of photography, almost a century ago. Talbot was born at Lacock Abbey, Chippenham, Wiltshire, on 11th February, 1800. He was a brilliant scholar, and later became a clever scientist who studied and wrote on photography, optics, astronomy, mathematical problems and archæology. His home became the meeting place of eminent scientists and scholars who gathered there for learned discussions.

While on a visit to Italy in 1883 Talbot was greatly impressed by the magnificent scenery in the neighbourhood of the Italian Lakes, and wished that he had the ability to sketch the wonderful views. Then the idea occurred to him of making a camera by which he could secure pictures of the scenery. Other experimenters had already tried in vain to perfect such an apparatus, but at the time Talbot did not know of their efforts. He converted a tent by the side of a lake into a camera by fixing a lens in the top in such a position that it reflected a picture of the lake on to a sheet of paper placed on a table in the middle of the tent. He then tried to trace the outline of the reflection, but found the task much more difficult than he had anticipated, and the result was very disappointing.

The idea then occurred to Talbot of finding some means of causing the picture to imprint itself on the paper, and when he returned home he began to experiment with certain chemicals that he knew responded to the action of light. Taking a sheet of writing paper he moistened it with a weak solution of common salt, and when the paper was dry bathed it in a solution of silver nitrate. He then exposed the sheet to light and was gratified to note that it darkened rapidly. He sensitised another sheet in the same manner, and when it was ready for use placed on it a piece of lace and exposed both to the sunlight. Shortly afterwards he removed the lace and found that a beautiful copy of it was printed on the paper. The sunlight had broken up the nitrate of silver on the exposed parts of the paper and turned them dark, while the parts that had been covered by the lace were still white. He then experimented with other thin objects, such as fern leaves, and obtained similarly successful results.

Talbot called these photographed impressions "negatives." He found that by placing another piece of sensitised paper under one of these negatives and exposing the two to sunlight he could obtain a second reproduction of the original. In this second picture the light and dark were reversed, however, the lace being reproduced against a white background. This print Talbot called a "positive," and the terms "negative" and "positive" are still in use.

What Talbot did successfully in 1835 can be done even more easily by any reader of the *"M.M.,"* for the sensitised paper may be purchased ready-made. The most suitable paper for the purpose is probably that known as self-toning paper, which may be purchased from almost any chemist. The most suitable subjects for sun pictures are thin leaves, ferns, pieces of lace and similar articles. The object to be photographed and the paper must be kept in close contact during exposure to light, and if a photographic printing frame is not available the object and the paper should be covered with a sheet of plain glass. The best period of exposure will be easily found after one or two experiments.



Two examples of photography of leaves without a camera.

Pictures obtained in this manner soon fade if daylight is allowed to reach them, but they may be "fixed," as it is called, by soaking them for several minutes in water in which hyposulphite of soda has been dissolved. The strength of this solution should be about four ounces of "hypo" to one pint of water, or as stated in the directions in the packet of paper. Prints become lighter in colour during this fixing process, and to allow for this they should be printed a little darker than they are required to look when finished. After fixing, the prints should be washed in running water for half an hour, or in several changes, and then they may be regarded as reasonably permanent.

The accompanying illustration gives some idea of how effectively the different characteristics of leaves are brought out by this simple method of photography. By a careful selection of different leaves quite a good range of sun photographs can be made, and a very interesting nature collection formed. After the prints have been fixed they should be mounted either in a slip-in snapshot album or in one of the many different types of paste-on albums. A neat caption should be written under each mounted print, giving the name of the leaf illustrated.

100% EFFICIENCY!

The Warneford "Moth" Flies **700 feet** at **15 m.p.h.** and **Rises from Ground**

Price **4/6**

WORLD'S RECORD BREAKERS

Other Fine Models **1/6** to **5** Gns.

WARNEFORD Flying Aircraft

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Price List of Models and Spares Free and Post Free from
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There's Good Health in—

KIA-ORA
LEMON ORANGE GRAPE FRUIT

Kia-Ora is the most healthful and delicious of all fruit drinks because it is the juice of the finest ripe fruit only, sufficiently sweetened with cane sugar. . . . Grape Fruit, Lemons and Oranges in their most convenient form, retaining to the full all the essential vitamins of the fresh fruit itself.

You will find Grape Fruit Squash excellent before breakfast—but all three are ideal drinks for any time and occasion. Ready for use by mixing with five parts plain or soda water.

Prices: Per large bottle, 2/-
Per full ½ bottle, 1/1

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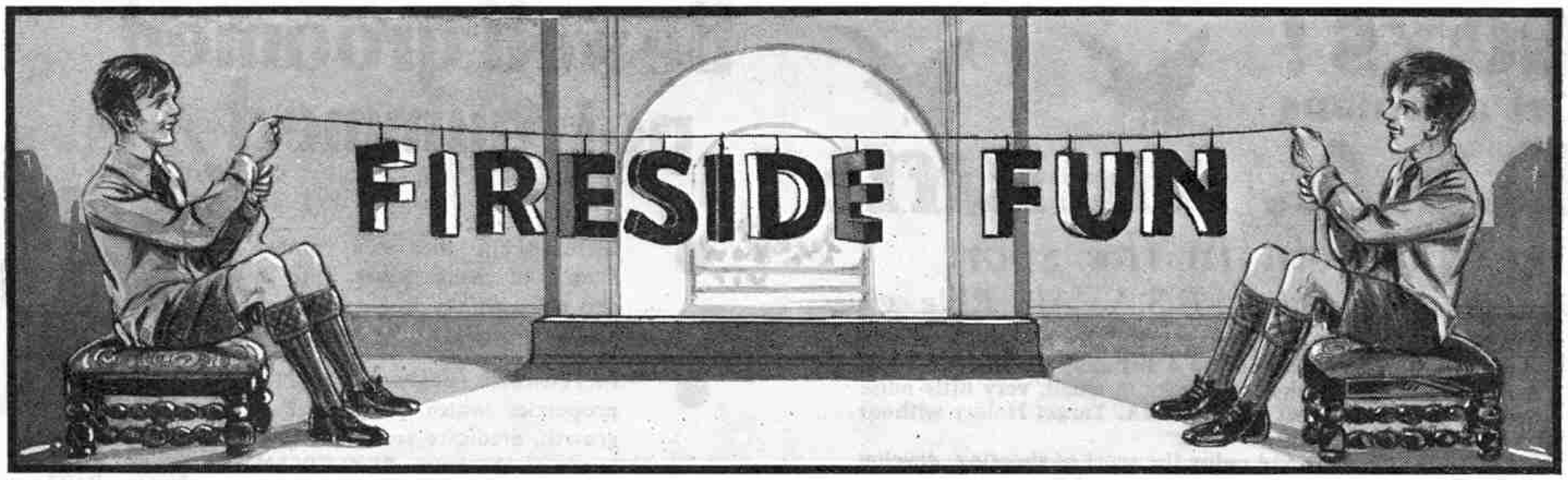


A BROAD HINT

"That smart new florist is certainly living up to his own slogan: 'Say it with flowers.'"

"Why, what does he do?"

"He sent me a bunch of forget-me-nots with my bill last week."

* * * *

Plumber (at phone): "What's that? A leak in the water pipe? Well, tell your husband to keep his hand over it. Just a tick and I'll let you know what day I can come."

* * * *

At a village singing contest one of the competitors became very nervous as his turn drew near. A friend, noticing this, said: "What's to do with thee, Billie? Tha looks frightened."

"I am that; it's my turn next. I'm terrified," was the reply.

"What's ta going to sing, Billie?"

"'I Fear No Foe!'"

* * *

"When is the next train out of this town?"

"Twelve o'clock, sir."

"What? Isn't there one before that?"

"No, sir; we never run one before the next."

* * *

Policeman: "No fishing allowed here."

Man with line: "I'm not fishing. I'm merely allowing this worm to bathe."

Policeman: "Let me see the worm, then."

Man: "Here it is."

Policeman: "You are arrested for allowing it to bathe without a swimming costume."

* * *

The three tramps had stopped for dinner, and one of them produced a large cake and a knife.

"Lemme see," he said, turning to one, "you don't like ends do you?"

"No," replied the other.

"Oh, well," said the first tramp as he cut the cake in two, "me and Bill does."

* * *

"Now, Henry," said the teacher, "An abstract noun is the name of something we cannot touch. Can you give me a good example?"

"Yes, miss! A red-hot poker."

* * *

Bore: "I don't know how it is, but I feel thoroughly wound up to-night."

Hostess (fed up): "How strange! And yet you don't seem to go."

* * * *

The minister was leaving the church after the evening service when a member of his congregation stopped him and said: "I like to come to church when you are preaching, sir."

"I'm glad to hear that," replied the minister. "It's nice to know that somebody appreciates my sermons."

"Oh it's not that," replied the woman. "I mean, it's so easy to get a seat, even when I arrive late."

* * * *

It was flag day for the hospital, and all the village maidens were selling flags.

Suddenly one noticed the squire's son coming down the street in his dashing sports car. She walked into the roadway and stopped him.

"Will you buy a flag for the hospital?" she asked demurely.

"No," growled the young man. "I'm a regular contributor to it. Have been for years—"

"Oh, yes," interrupted the girl, "we know, but we're collecting money to-day, not pedestrians."

TWO SMILES

The miserly costermonger smiled happily at the thought that his donkey was enjoying a free feed.

"You're a good little girl to be so kind to a dumb friend," he said. "But who gave you the carrots?"

The good little girl also smiled happily. "I took them from the back of your barrow," she said.

* * * *

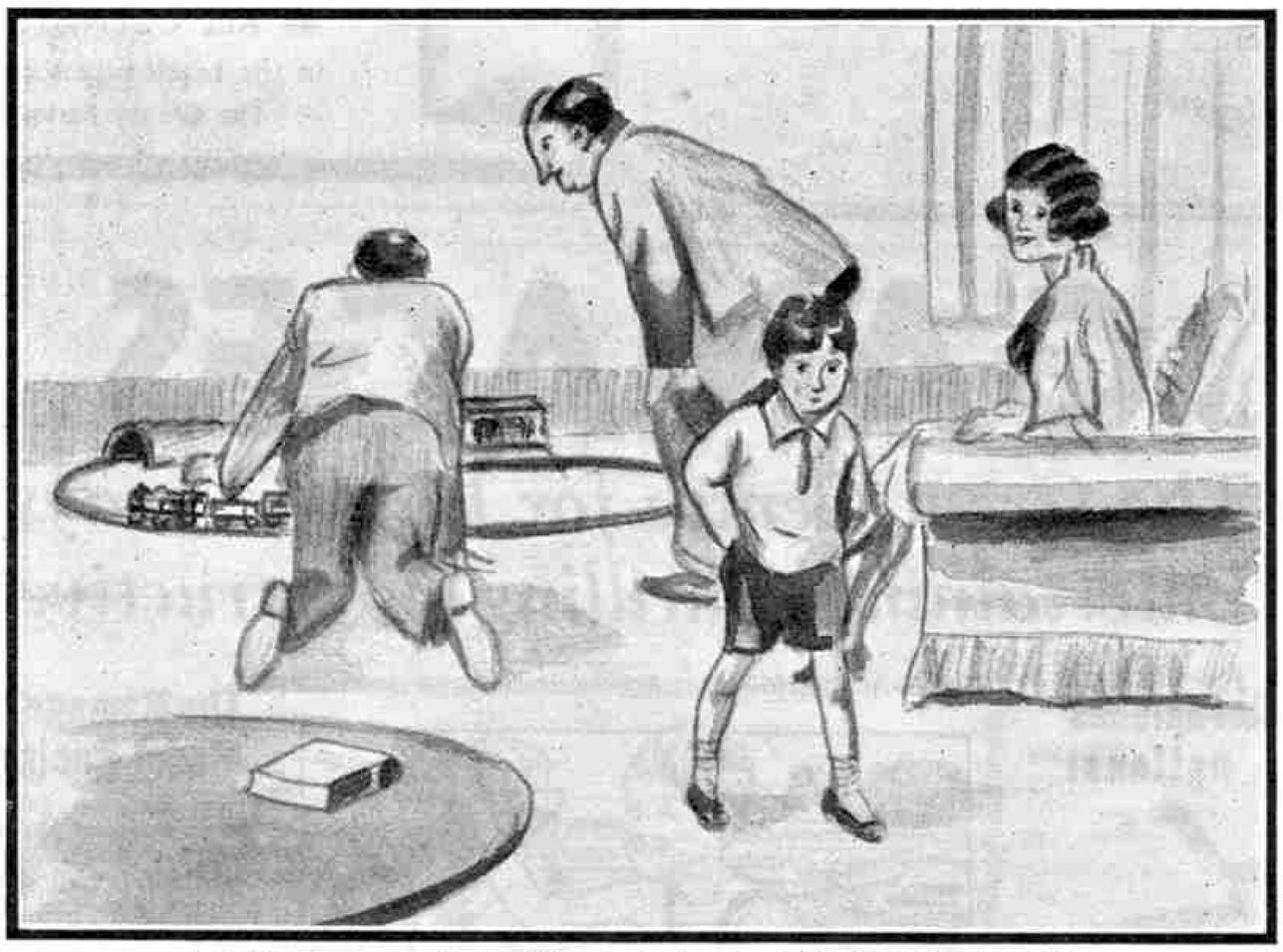
Sandy: "So ye didna' go awa' for a holiday this year, Mac?"

Mac: "No, Sandy. The Macgregors wrote an' invited me to their place, an' I'd like to have gone, but they forgot to enclose a stamped envelope for a reply."

* * * *

Warder: "What! You back again!"

Convict: "Yes. Any letters or parcels fer me?"



"Why do you call your Hornby Train the 'Ghost Train dear?"
"Because I hardly ever see it!"

This drawing, by L. S. Hill (Southall, Middx.), gained second prize in the A Section o the February Drawing Contest.]

Lady (to gardener): "Why is it, Brown, that although you're a gardener, I never see you wearing a buttonhole?"

Brown: "Well, ma'am, do you ever see a butcher go about with a pork chop hanging round his neck?"

* * * *

"If you really want work, Farmer Giles wants a right-hand man."

"Jus' my luck, lidy—I'm left-'anded!"

* * * *

Diner (who had been particularly difficult): "Have you any wild duck?"

Waiter (fed up): "No, sir, but we can take a tame one and irritate it for you."

* * * *

Counsel for the victim of a motoring accident: "Members of the jury, the driver of the car has proved that he was only going four miles an hour. Think of it! Think of the agony of my client as the car drove slowly over his body at four miles an hour!"

* * * *

The Lady: "Are you really content to spend your life walking about the country begging?"

Tramp (soulfully): "No, lady, many's the time I've wished I had a motor car."

PUT TO THE TEST

Willie: "Mother, that dentist you sent me to who was advertised as painless, wasn't."

Mother: "He wasn't?"

Willie: "No, I bit his finger, and he yelled just like any other dentist."

* * * *

"How did you like the show?"

"It was the worst picture I ever cinema life."

* * * *

"I told the cook to prepare a chicken so that it would tickle my palate."

"Did she obey?"

"Yes, she left half the feathers on."

* * * *

"After I'd sung my encore, I heard a gentleman from one of the papers call out 'Fine! Fine!'"

"Dear me! And did you have to pay it?"

* * *

Fond Father: "Come, Tommy, even if you have hurt yourself a bit, you shouldn't cry."

Tommy: "What's—crying—for—then?"

* * *

Mr. Bore: "My memory is excellent. There are only three things I can't remember. I can't remember names nor faces and—and I forget what the other thing is."

* * *

The Sunday school teacher had just read aloud the parable of the Prodigal Son to a class of small boys.

"Now," said she, "who was it that was least pleased to see the Prodigal Son return?"

This rather puzzled the boys, but shortly a small voice replied: "Please, miss, the fatted calf!"

* * *

Tramp Woman: "'Ave you any old shoes, lidy?"

Lady (with a glance down at the supplicant's feet): "I'm afraid mine wouldn't fit you."

Tramp: "Oh, that's all right, lidy. I likes 'em easy."

* * *

Fred was being sent to a boarding school.

"Now," said his father, "when you write don't send me pages and pages describing all the pupils, where they come from, and what class they are in, because I shall not have time to read it all."

A few weeks later his father received the following letter: "Dear Father, S.O.S., L.S.D., R.S.V.P.—Fred."

* * * *

Anchor was dropped outside the harbour.

"What have we stopped for, captain?" inquired an old lady.

"Fog too thick, madam. Can't see into the docks."

"But, captain, the fog isn't very thick, I can see the stars."

"Yes, madam, but we're not going that way unless the boiler busts."

* * * *

"When I was a little child," the sergeant addressed his men at the end of an exhausting hour of drill, "I had a set of wooden soldiers. There was a poor boy in the neighbourhood and after I had been to Sunday School one day and listened to a stirring talk on the beauties of charity I was softened enough to give them to him. Then I wanted them back and cried, but my mother said:

"'Don't cry, Bertie, some day you will get your wooden soldiers back.'

"And believe me, you lop-sided, mutton-headed, goofus-brained set of certified rolling-pins, that day has come."

BOYS!
Get a famous
B.S.A. Air Rifle
and join in the sport
that shooting with a B.S.A. Air Rifle gives

Kill vermin such as rooks, rats, rabbits, etc., and test your skill as a marksman on a target or on a swinging tin in the garden. A B.S.A. Air Rifle makes no smoke or smell, very little noise and can be used indoors with a B.S.A. Target Holder without fear of damage to walls, etc.
Get a B.S.A. Air Rifle and enjoy the sport of shooting, develop keen eyesight, steady nerves and self-confidence.
B.S.A. Air Rifles shoot inexpensive B.S.A. lead pellets which cost only 2/3 a 1,000 (.177″ size).
The B.S.A. "Breakdown" Air Rifle is specially suitable for boys.

Prices from **45/-** or **4/3** a month

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Post the coupon NOW!

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Be well groomed not gummed!

- BRYLCREEM does not contain Gum, and cannot cause flake in the hair, or set it hard—yet it controls the hair perfectly.
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Avoid injurious substitutes.

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BRYLCREEM
The Perfect Hair Dressing

AT ALL CHEMISTS, HAIRDRESSERS AND STORES.
In the black screw cap bottle. **9d., 1/-, 1/6** and **2/6.**
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HORNBY TRAINS
and
SPEED BOATS

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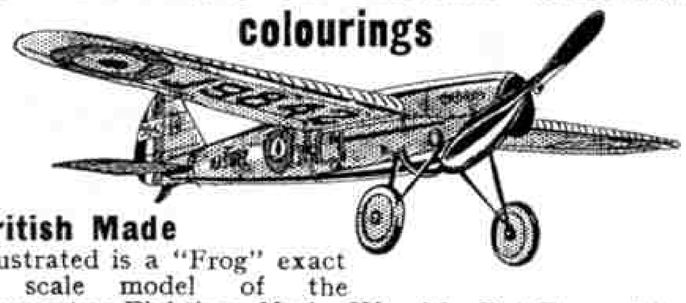
The Famous "Frog" Model Aeroplanes now available in various national colourings



British Made
Illustrated is a "Frog" exact to scale model of the interceptor Fighting Mark IV with R.A.F. markings which are in actual colour. Will fly 300 ft. at a height of 70 ft. Rises straight off the ground. Also obtainable in the following national colours: Argentina, Belgium, France, Italy, Holland and U.S.A. Complete in patented container box. Price each **7/6** Post 6d.

BOYS! THIS FINE RUBBER BOAT IS OFFERED AT THE LOWEST PRICE ON RECORD

Here is a really well made Rubber Boat at the lowest price ever. Just the boat for your holidays and ideal for surf bathing. Made in exceptionally heavy rubber, in assorted colours. Towing rope attached. Note the large size—36 in. long. Inflated in a jiffy. *Foreign.* Post 9d. Price only **7/6**

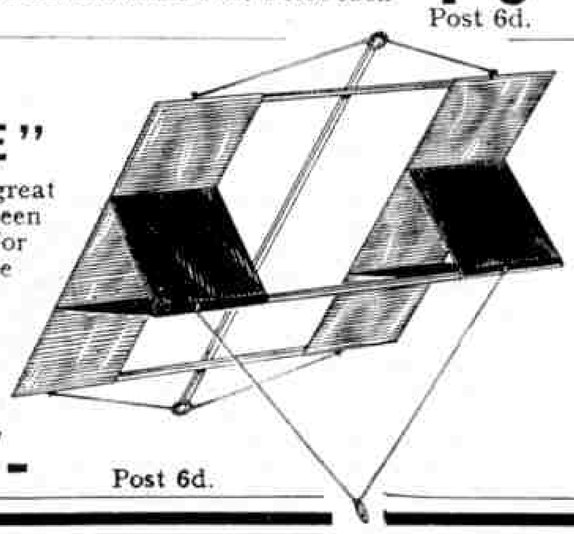
The Gamage "Shamrock" Model Racing Yacht

The hull is correct to scale in dimensions and profile of the latest "Shamrock." Deck is cambered, hull carved from best yellow pine, "Bermuda Rig," sails made from spinnaker cloth. Hull is enamelled sea green. Deck is lined and varnished. Stand supplied.

Length 27 in. Price **21/-**

GAMAGES "ALTIKITE"

This Kite is a great flier and has been specially built for Gamages. Note the size, 25 in. x 25 in. It is undoubtedly the best value ever offered at the price. Price **2/-** Post 6d.



Something New!
WORKING MODEL PETROL PUMP

An ingenious working model that is just the thing for a model Garage. Fitted with an efficient pump and two containers with measuring scale. Works with water. Height 8 in. Finished in bright red enamel. Price **4/11** Post 6d.

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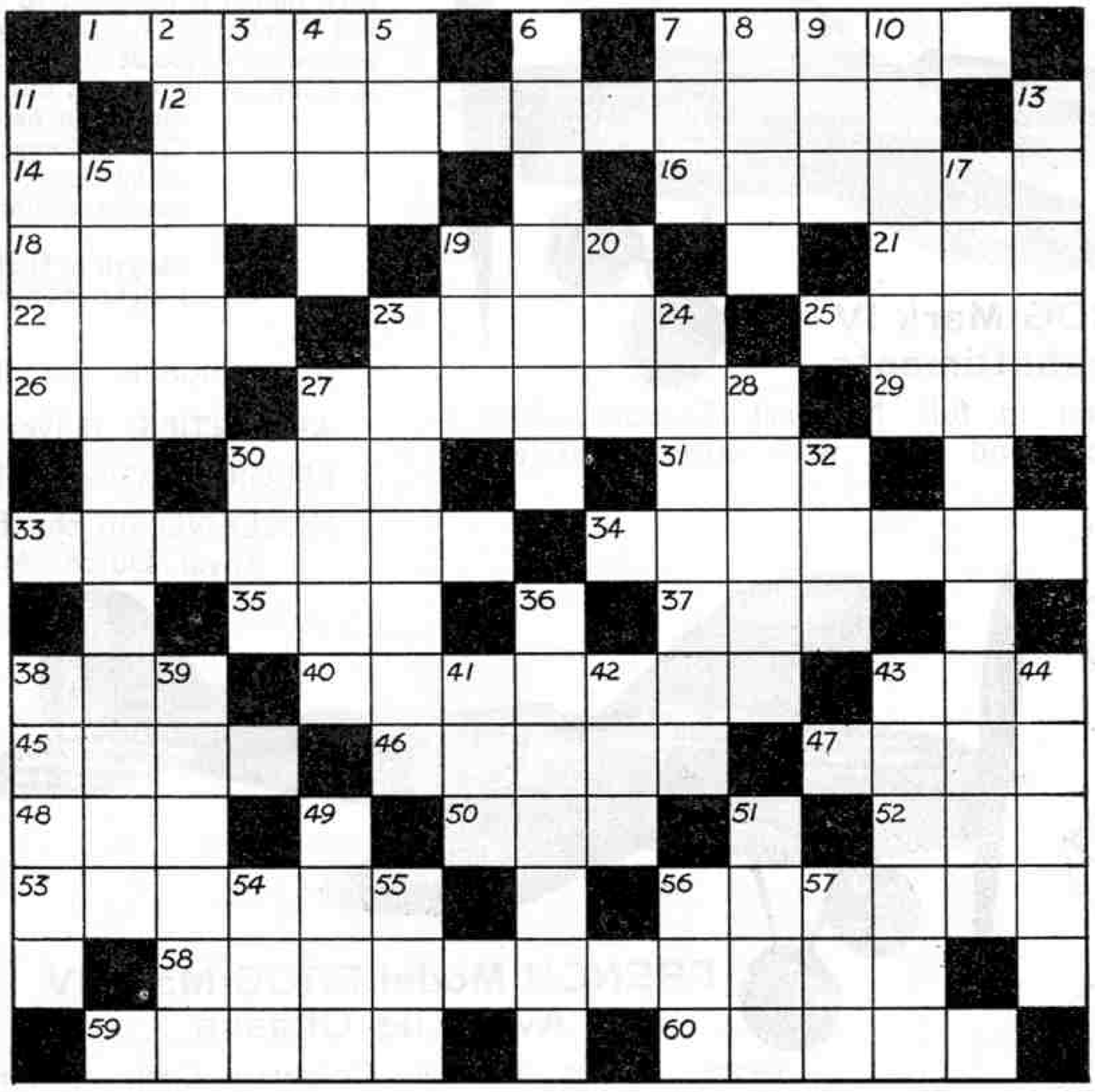
Telephone: HOLborn 8484. Also at 107, Cheapside, E.C.2.

Competition Corner

JUNE CROSSWORD PUZZLE



CLUES ACROSS

1. Balkan capital
7. Wrathful
12. Reviver
14. Interweave
16. Formal talk
17. Period of time
19. A bladed pole
21. Lowing sound
22. Difficulty
23. Cancel
25. Prohibit
26. Sun
27. Arranged
29. Mark
30. Possessive pronoun
31. Number
33. Hardened
34. Tinged
35. Achieved
37. Measure
38. Concreted sugar
40. Interferes
43. A Military Personage (Init.)
45. Plant
46. Baits
47. Tiny
48. Theory
50. Spoil
52. Confine
53. Hoods
56. Snakes
58. Jewish temples
59. Warning signal
60. Canvas shelters

CLUES DOWN

2. Trial
3. Full
4. An island
5. Devoured
6. Moaned
7. Possessive pronoun
8. Ready
9. Hail
10. Poured
11. Stupid
13. Kill
15. Unbelief
17. Shrub
19. Number
20. Flow
23. Naval stores
24. Literary culture
27. Guide
28. Transacts
30. Shape
32. Nothing
36. Overstrains
38. A famous poem
39. Hostility
41. Quiet
42. Before
43. Choicest
44. Propriety
49. A Grecian Goddess
51. Unemployed
54. Conveyance
55. Coin
56. Play
57. Haunt

It is perhaps too much to expect that this month will pass without our being compelled to seek an indoor pastime to while away an hour or two of inclement weather.

A crossword puzzle is an ideal companion on such occasions and the puzzle on this page will be found to follow the lines of all our previous puzzles, in that it is for amusement only. Every effort has been made to eliminate traps in the form of unfair alternative solutions, and the clues will be found to be perfectly straightforward. Every word used can be found in Chambers' or any other good dictionary, with the exception of one or two proper nouns that are well known to all. The rules governing the solution of crossword puzzles are so well known, however, that it is unnecessary to give any further explanation of the requirements of the competition.

Prizes of Meccano or Hornby Train goods (to be chosen by the winners) to the value of 21/–, 15/–, 10/6 and 5/– respectively, will be awarded to the senders of the first four correct solutions, in the order in which they are opened on the morning following the closing date. In addition there will be a number of consolation prizes, and in awarding these neatness and style of presentation will be taken into consideration.

Entries should be addressed " June Crossword Puzzle, Meccano Magazine, Binns Road, Liverpool 13," and must be sent to reach this office not later than 30th June. A duplicate set of prizes will be reserved for Overseas entries, which must reach us not later than 30th September.

Competitors should not mutilate their magazines by cutting out the crossword illustration. Instead they should make a copy of the square on the same scale, or larger, and make use of that for the Contest.

June Photo Contest

As we announced in our April issue, our photographic contests this year are again open to photographs of any subject. The prizes are awarded to the best photographs submitted each month, irrespective of subject, size, make of camera, plate, film or paper. The only restrictions are that each print must bear a title and that the exposure must have been made by the competitor. The developing and printing may be carried out professionally. In addition to its title, each print must bear on its back the competitor's name, age and address.

The competition will be divided into two groups, Home, for those living in Great Britain, Ireland and the Channel Islands; and Overseas, for those living outside those areas. Each group will be divided into two sections, A for those aged 16 and over, B for those under 16; in each of which prizes of Meccano products or photographic materials (to be chosen by the winners) to the value of 21/– and 10/6 will be awarded.

Entries sent this month must be addressed " June Photo Contest, Meccano Magazine, Binns Road, Liverpool 13 " and must arrive not later than 30th June. Overseas closing date, 30th September.

Unsuccessful entries will be returned if a stamped addressed cover is sent for the purpose.

COMPETITION RESULTS

HOME

Aerodrome Errors.—1. F. Ashton (Spalding); 2. C. Eagling (Mortlake, S.W.14); 3. M. G. K. Byrne (Hull); 4. A. W. T. Vale (Streatham, S.W.16).

Engineering Short Story.—1. B. J. Greenhill (Bristol); 2. A. M. Johnston (Dunstable); 3. F. Gardner (Darlington); 4. H. G. Bradshaw (Newcastle). Consolation Prizes: S. H. Farr (Gravesend); Mrs. Z. Manners (Newport).

OVERSEAS

December Crossword.—1. J. Hers (Johannesburg); 2. MacL. Morgan (Cremorne, N.S.W.); 3. W. L. Barry (Christchurch, N.Z.); 4. W. L. Carroll (Pretoria).

Feature Voting Contest.—1. F. G. Hide (South Canterbury); 2. F. Wilson (Malta); 3. R. Inch (Montreal); 4. D. Atkinson (Yalwal, N.S.W.).

December Stamp Contest.—1. Miss E. Worthington (Vancouver); 2. Mrs. E. H. R. Tenison (Colombo); 3. C. R. Wallace (Sea Point, C.P.); 4. N. J. Paola (Durban).

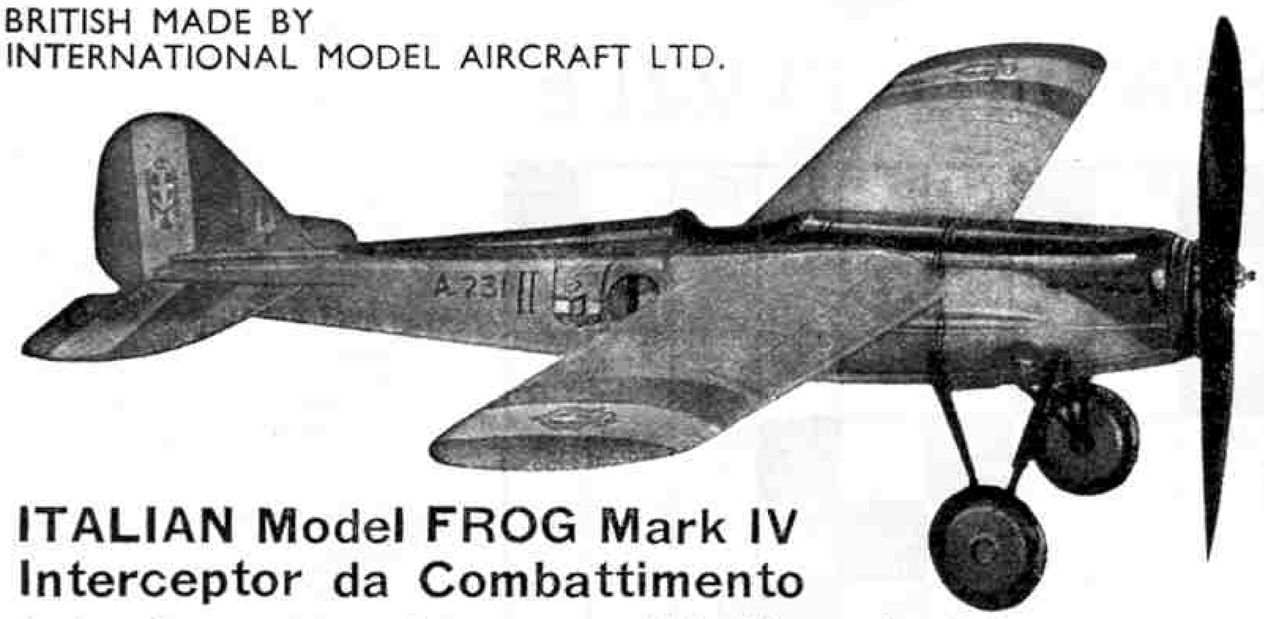
FROG

FLYING SCALE MODEL AIRCRAFT

TRADE MARK REGD.

(Interceptor Fighter MKIV)

BRITISH MADE BY
INTERNATIONAL MODEL AIRCRAFT LTD.



ITALIAN Model FROG Mark IV
Interceptor da Combattimento

A handsome reproduction in full National Colours :—Red, White, Green, Pale Yellow, and Blue with correct Insignia.

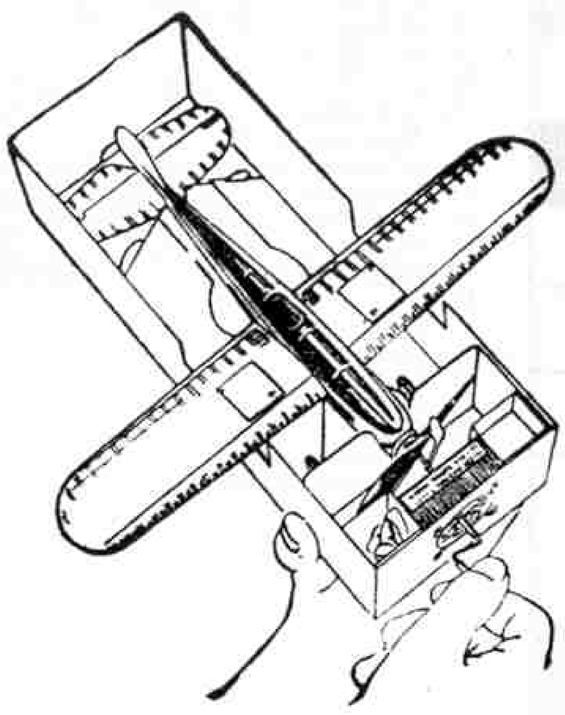
A REALISTIC AEROPLANE :—
the only true scale model that really flies

Each model is designed to fly ; is already tested in flight, and is delivered in flying trim. With a true to scale speed, equivalent to 236.36 m.p.h., the most interesting experiments in flying can be carried out, and stunts such as looping the loop can be ordered at will.

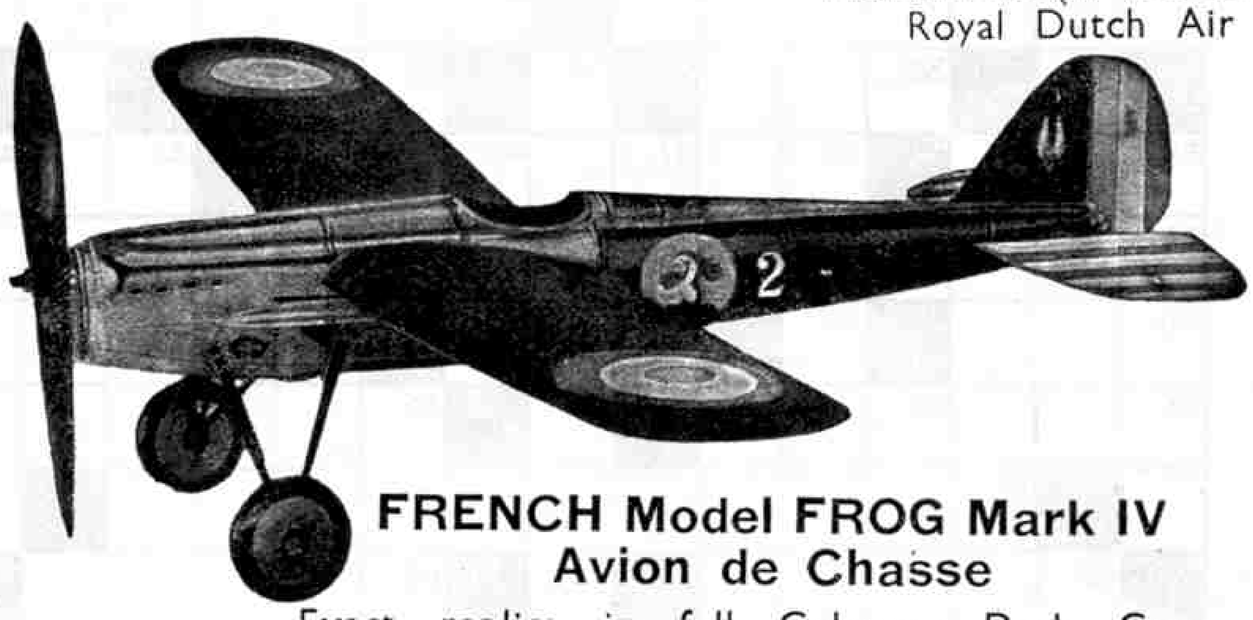
Overall Length . .	9½ in.
Wing Span	11¾ in.
Normal Flying Speed	650 feet per min.
Length of Flight	300 feet
Height of Flight	70 feet

Models not illustrated are :—

ARGENTINE (Silver and Blue).
BELGIUM (Silver, Red and Yellow).
HOLLAND (in the full colours of a K.L.M. Royal Dutch Air Liner).



Can be completely wound in patent container box for flight in 15 seconds.



FRENCH Model FROG Mark IV
Avion de Chasse

Exact replica in full Colours :—Dark Green, Red, White and Blue and correct Service markings.

ALL MODELS AT NEW REDUCED PRICE

7/6

Complete with MECHANICAL WINDER SPARE MOTOR GEAR BOX OIL and MOTOR LUBRICANT

U.S.A. Model FROG Mark IV Single Place Pursuit Ship

A splendid Model of an American Military Aeroplane beautifully produced in the correct Colours and Squadron markings.

The F.R.O.G. Club

The object of the Club is to encourage owners of F.R.O.G. Model Aircraft to obtain best results from their machines.

Handsome badges are given to those who are successful in passing the necessary proficiency tests.

Your dealer will give you full particulars and entry forms, or you can write to us direct for them.

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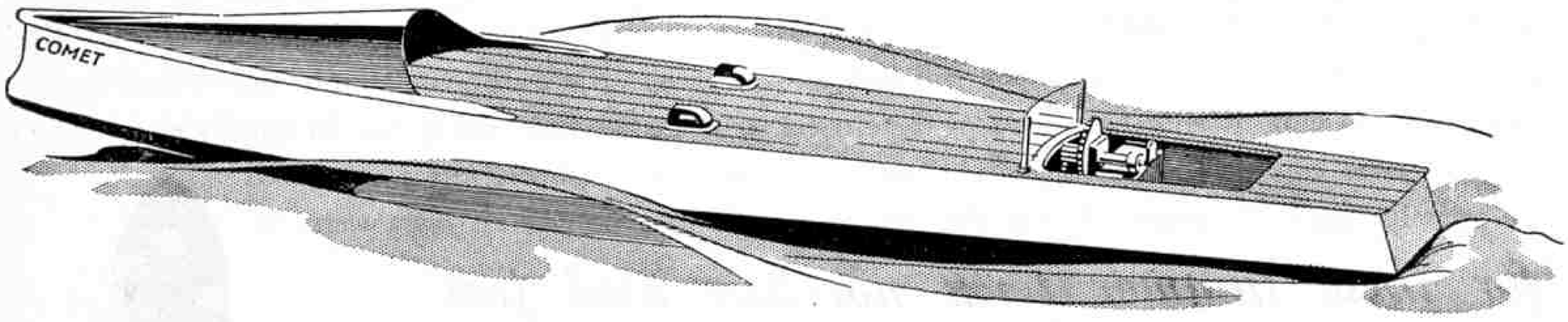
"SWIFT AS A COMET!"



All you model boat enthusiasts, why not hoist your racing colours on a Bowman "Comet," the speed boat that *wins* races and *beats* records? Read the specification below and then see one at your model shop.

THE "COMET." *Patent wood hull and aluminium spray hood. Length, 30". Beam, 3½". Polished birch deck, tongued to represent boards, entirely new type high speed, long running clockwork motor and starting lever. Polished cellulose finish. In strong wood box. Postage 1/-* **20/-**

Whichever kind of model attracts you most, clockwork, steam or rubber-driven, there's a wonderful range of Bowman models built to give you endless fun and enjoyment. The **Bowman Catalogue**, a splendid production packed full of interesting illustrations and descriptions, will tell you all about them and all the other Bowman Models.

To get YOUR copy send 3d. in stamps to

BOWMAN MODELS

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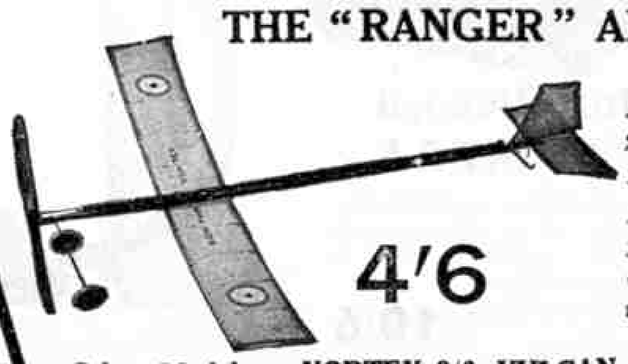
THE "SWALLOW." *An attractive and popular steam launch. Steams for 20 minutes on one filling. Patent wood hull. Length 20". Beam, 3½". Bowman Engine, ¾" stroke × ⅝" bore. Polished brass boiler, 4½" × 1½", safety valve and overflow tap. Safety type lamp. With filler and instructions in wood box. Postage U.K. 9d.* **17/6**

THE 'WHIRLWIND." *A marvellous rubber-driven Racer 27" long is a really snappy boat for* **1/3**

THE "RANGER" AEROPLANE



Span, 24". Length, 24½". Propeller, 9½". Flies 650 feet. Best proofed silk covered planes. Shock proof chassis–aluminium wheels. Post free.

4/6

Other Models: VORTEX 8/6, VULCAN 6/6, BULLET 2/6

Hamleys News

Estd. 1760.
200 REGENT STREET W.1

(SPECIAL MODELS AND GAMES SUPPLEMENT)

NUMBER 2 JUNE, 1933

GREAT PARADE OF 7,000 TOY SOLDIERS

Exact Model of the Aldershot Tattoo

HOW YOU CAN SHOW YOUR SKILL WITH THE "BIFBAT"

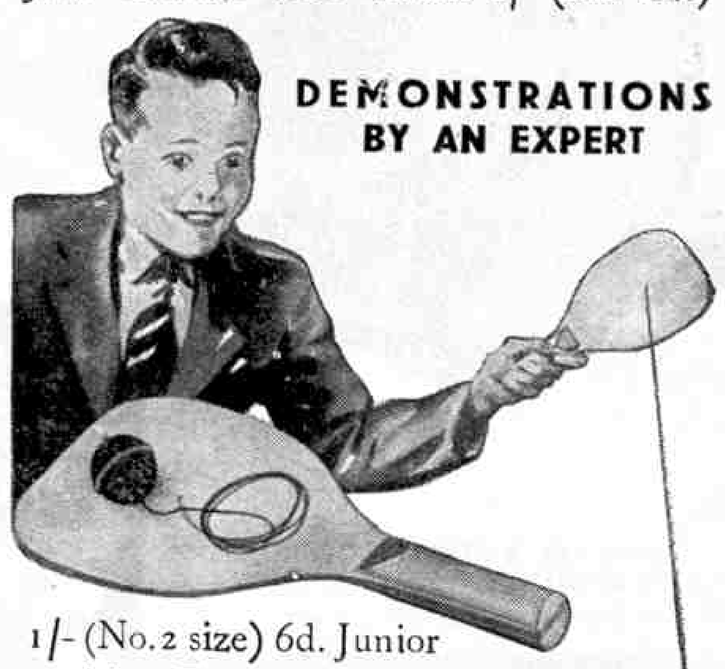
—and Win Prizes too!

Boys, take the first opportunity you get this month to see the great pageant of toy soldiers at Hamleys in Regent Street. It is the finest exhibition of model soldiers ever seen in London. The regiments are represented just as they will be seen in the grand final scene of the Aldershot Tattoo. Some of the models are unique, and you will probably never see such a glorious collection of toy soldiers in your life again.

LONDON'S LATEST CRAZE

Who is going to be the first boy in your school to do the "Spread Eagle" with the "Bifbat"? There are dozens of other tricks you can do, "Zig-Zags," "Volleys," "Half Circles" and none of them as easy as they look.

At Hamleys you will find an expert who will show you how these tricks are done. Soon there will be announced valuable prizes all over the country for the best performers with the "Bifbat." So practice hard *and get your "Bifbat" from Hamleys now.* Prices 2/- (full size)



DEMONSTRATIONS BY AN EXPERT

1/- (No. 2 size) 6d. Junior model. Postage 3d.

WHY NOT BATHING IN THE GARDEN!

If you get a chance bring Father along to see the bathing pool at Hamleys. Tell him you could have one just like it in your garden if you had a canvas SPORTA-POOL. You fill it by the ordinary garden hose and it can be quickly emptied and stowed away or moved where you want it.

Send now for these summer term novelties and fun

Thornton-Pickard PUCK CAMERA

By means of a special screen inside the camera, this fine all-metal portrait camera can give you either 16 or 8 exposures on an ordinary 3½ x 2¼ standard film. It costs only - - - **10/6**
Postage 9d. extra.

Plated-Frame CATAPULT with an accurate range of over 50 yards. Price **2/3**
Postage 4d. extra.
Round lead shot 1/- per lb.

New design,
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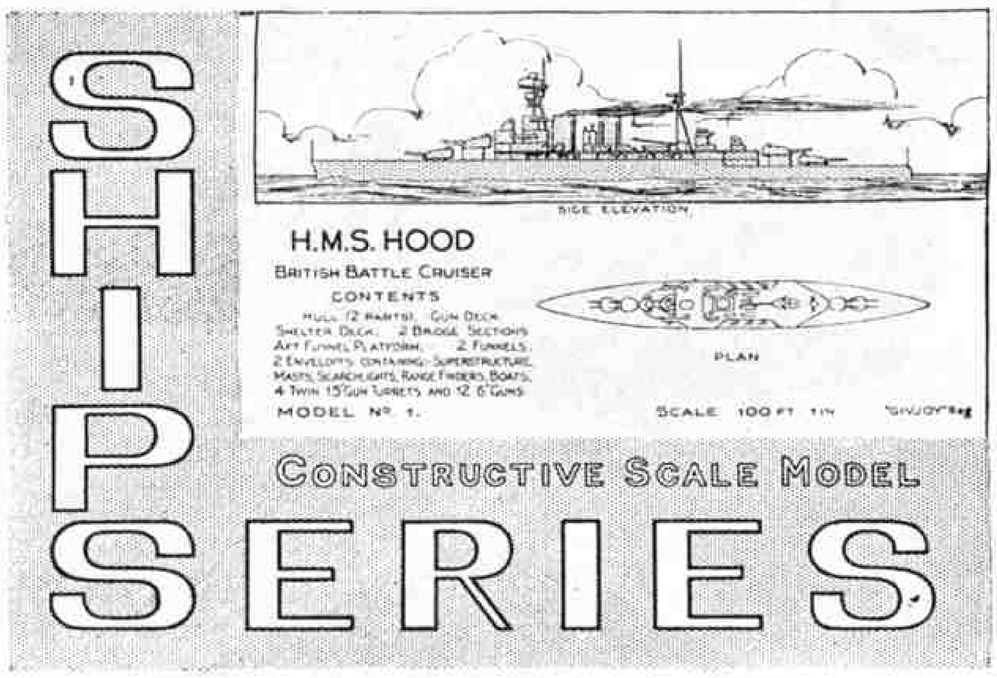

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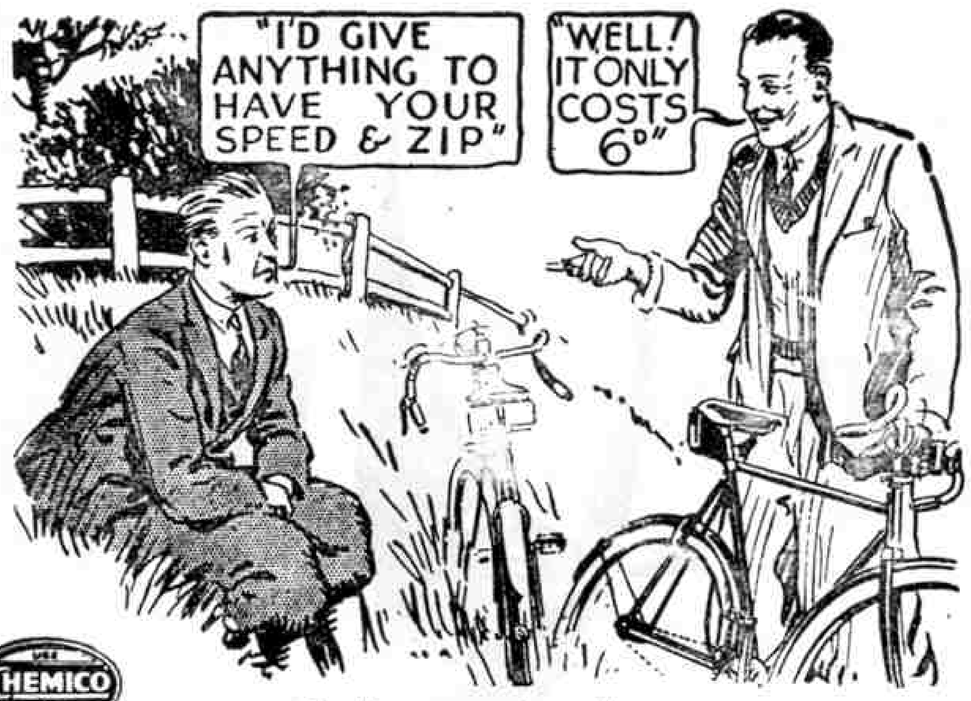

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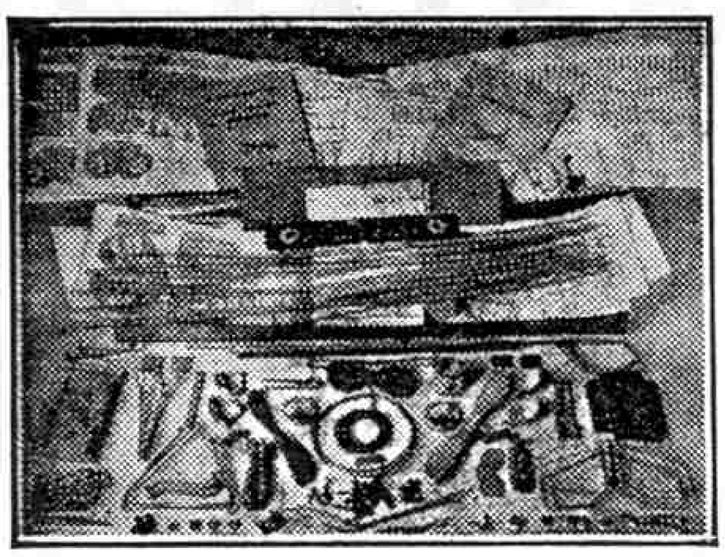

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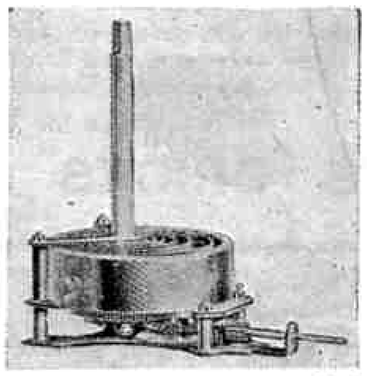

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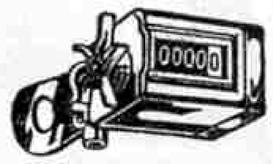

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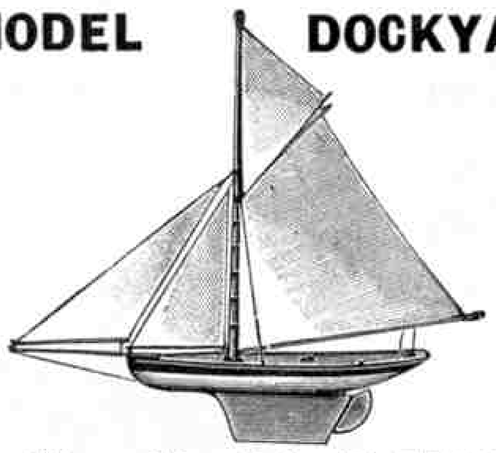

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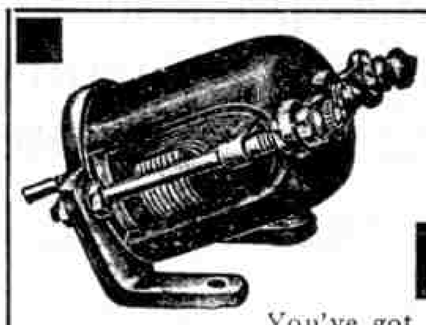

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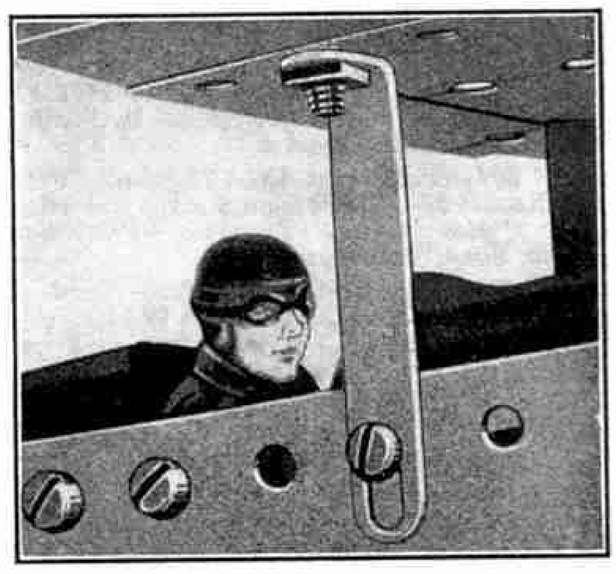

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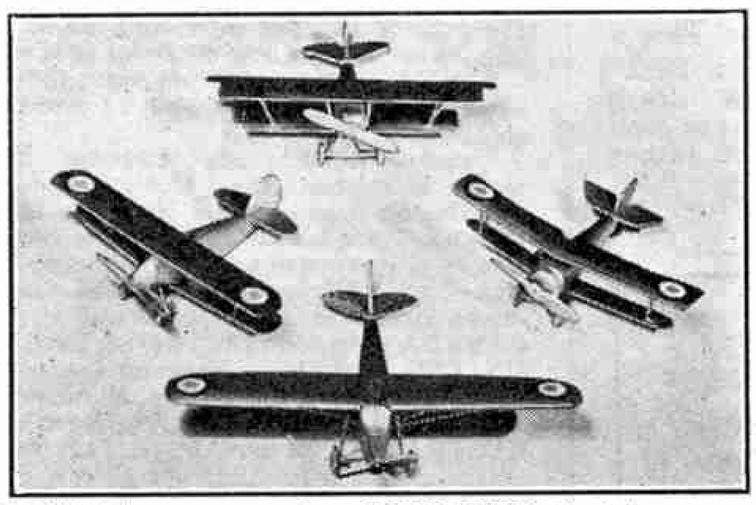

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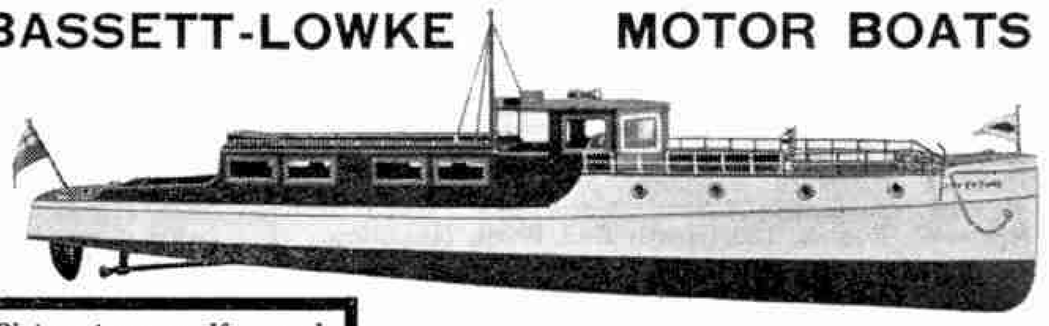

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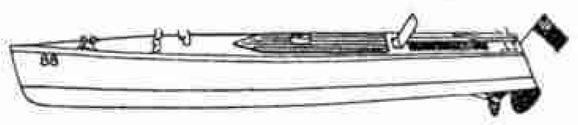

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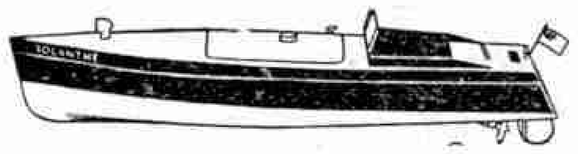

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MECCANO MAGAZINE

Registered at G.P.O., London, for transmission by Canadian Magazine Post.

EDITORIAL AND ADVERTISING OFFICE:—

LIVERPOOL 13, ENGLAND.

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To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

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The Editor wishes to make known the fact that it is not necessary for any reader to pay more than the published price. Anyone who is being overcharged should lodge a complaint with the Meccano agent in his country or write direct to the Editor.

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An interesting model-building competition was held at Sutton by William Pile Ltd., and a Meccano representative was sent specially to judge the entries, which were interesting and of good quality. The awards were as follows:—

Class A, boys 5 to 8 years, G. Rowley (Floating Dock). Consolation Prize, M. Parker (Motor Truck). Class B, boys 9 to 12. First Prize, P. H. Vine (Block setting Crane); Second Prize, C. Sutton-Smith (Six wheeled Lorry). Class C, boys 13 to 15. First Prize J. Finfield (Sports Saloon Car); Second Prize, E. Gawne (Racing Car).

MECCANO

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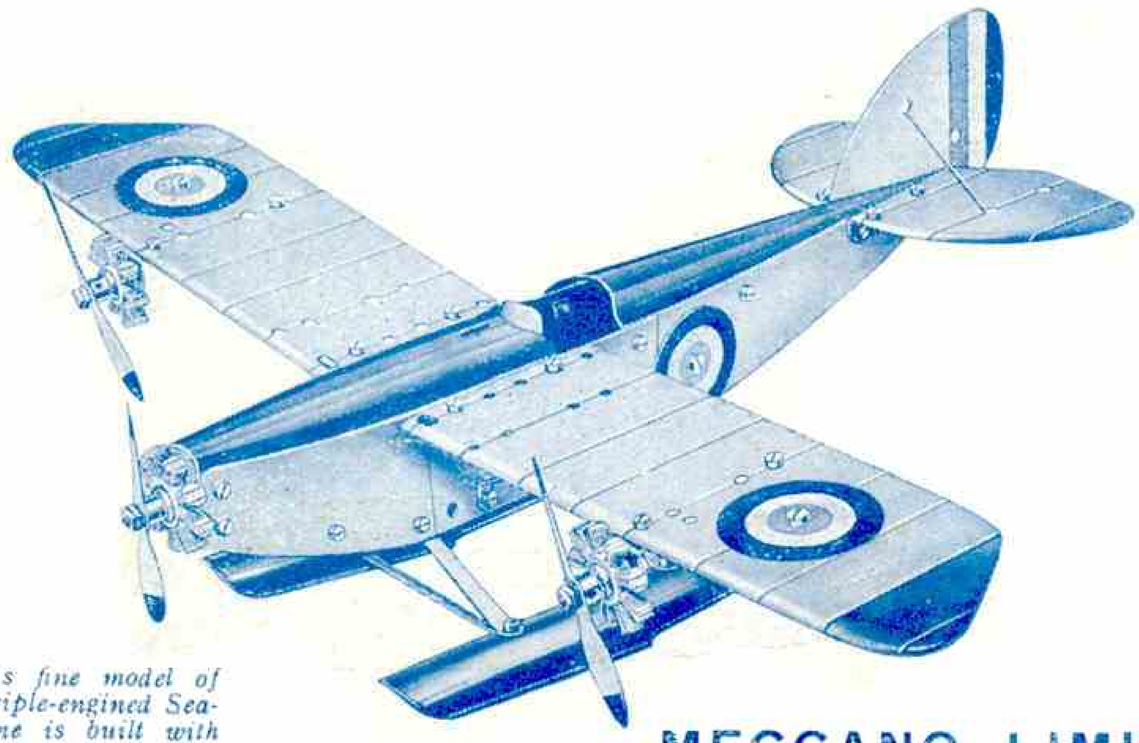

This fine model of a triple-engined Seaplane is built with Meccano Aeroplane Constructor Outfit No. 2.

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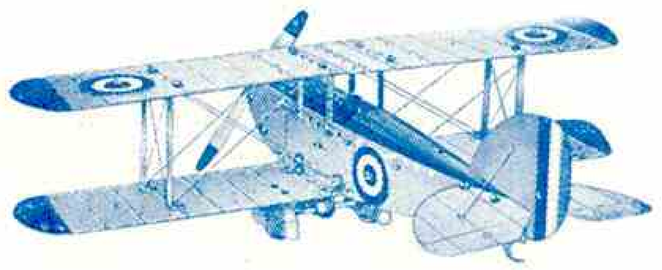
The above illustration shows a model of a Biplane built with Meccano Aeroplane Constructor Outfit No. 0



This model of a Standard Light Biplane is based on the type that is generally used for civilian flying. It is a No. 1 Outfit model

Aeroplane Constructor Outfit No. 1

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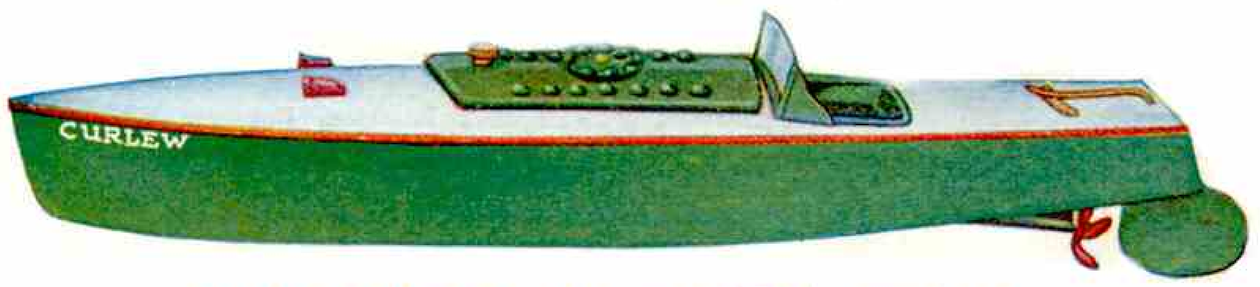

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